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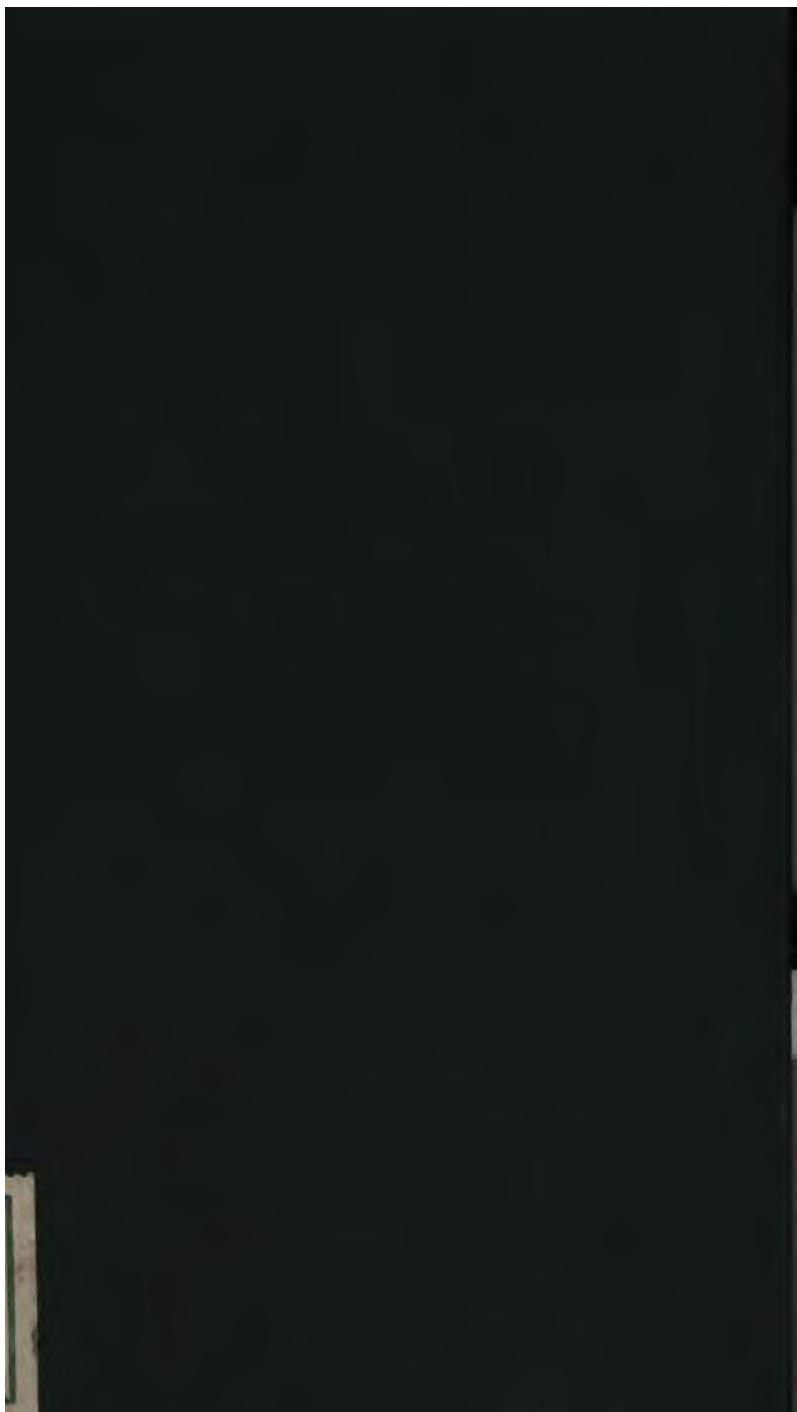
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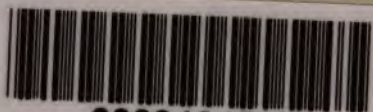
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A
K E Y

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TO

(Will.) TAYLOR'S
ARITHMETICIAN'S GUIDE:

CONTAINING

ANSWERS TO ALL THE QUESTIONS

IN THAT WORK ;

WITH SOLUTIONS AT FULL LENGTH WHEREVER THERE
IS THE APPEARANCE OF DIFFICULTY.

By W. H. WHITE,

HEAD MASTER OF

THE COMMERCIAL AND MATHEMATICAL SCHOOL, BEDFORD:

AUTHOR OF

THE YOUNG STUDENT'S INTRODUCTION TO ARITHMETIC;

A COMPLETE COURSE OF ARITHMETIC;

&c. &c. &c.

LONDON:

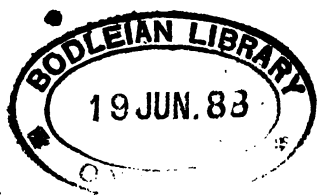
PRINTED FOR

LONGMAN, HURST, REES, ORME, AND BROWN,

FATERNOSTER-ROW.

1823.

1802. e. 40



Printed by A. and R. Spottiswoode,
Printers-Street, London.

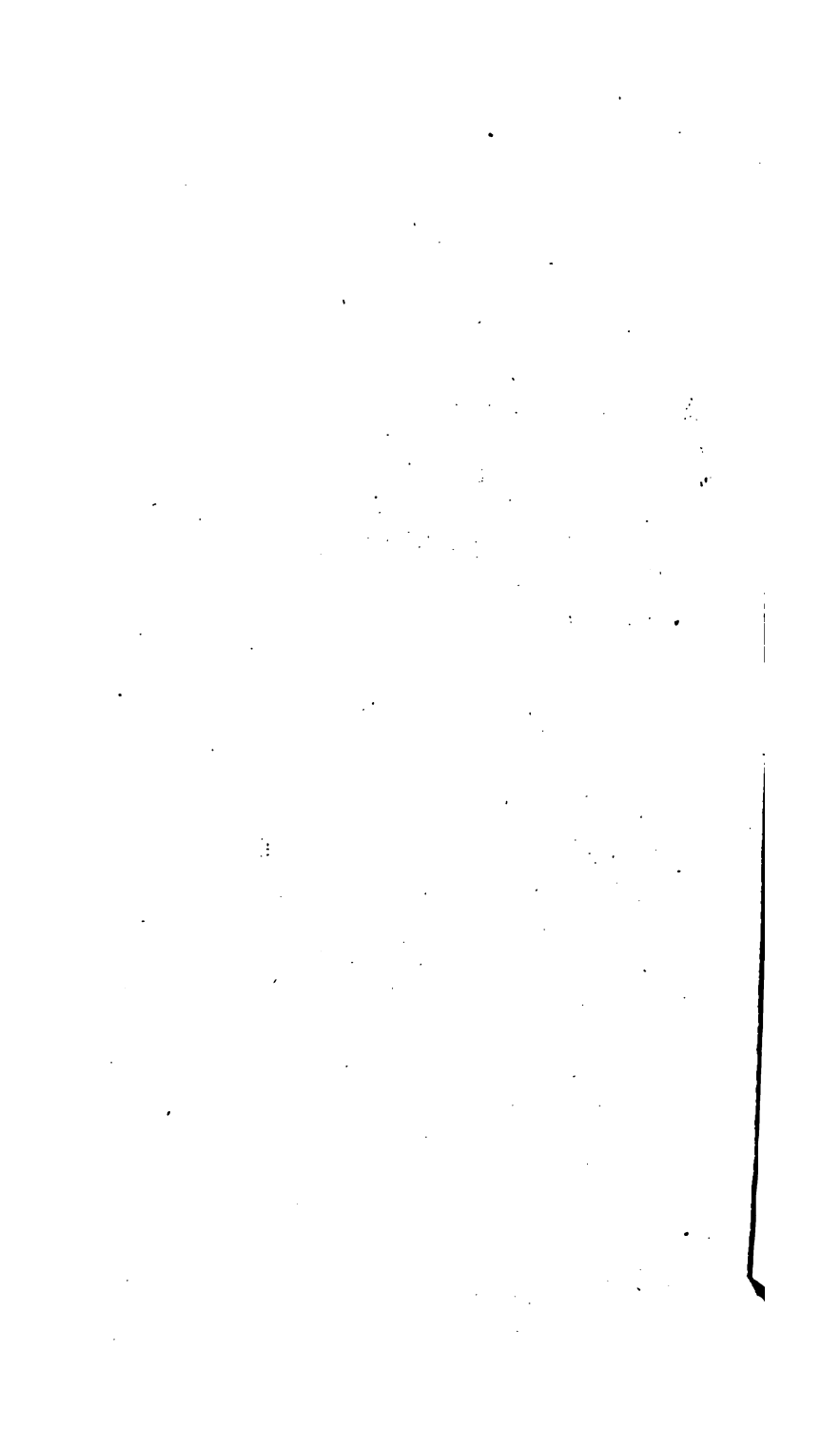
ADVERTISEMENT.

ALTHOUGH the title-page seems to explain the nature of the present volume, yet, as there is a considerable difference between the original Key, published by the Author of the *Arithmetician's Guide*, and the present work, it may not be amiss, briefly, to point out wherein that difference consists.

In the original Key, every question was worked at full length, and, in many cases, in a very long and tedious manner; in the present work, the questions are solved in the most concise and simple manner possible, by which means the progress of the pupil will be greatly facilitated and the labor of the Teacher infinitely lessened.

SELF STUDENTS, who make use of the *Arithmetician's Guide*, will best promote their progress by first solving the questions themselves, and then comparing their solutions with those contained in the following pages.

BEDFORD,
January 1. 1823.



A
K E Y
TO THE
ARITHMETICIAN'S GUIDE.

NUMERATION.

Numbers to be expressed in Words, answered.

EXAMPLE (1) One thousand seven hundred and eighty-five.

(2) Three hundred twenty four thousand, five hundred and sixteen.

(3) Six hundred and fifteen thousand, four hundred and twenty-three.

(4) Seven millions six hundred and fifty-four thousand, three hundred and twenty-one.

(5) Eighty-seven million, six hundred and fifty-four thousand, three hundred and twenty-one.

(6) Nine hundred and eighty-seven million, six hundred and fifty-four thousand, three hundred and twenty-one.

(7) Four hundred and twenty-six thousand, seven hundred and eighty-four millions, three hundred and twenty-six thousand, five hundred and thirty-four.

(8) Six hundred and forty-two billions, one hundred and thirty-four thousand two hundred and ten millions, three hundred and forty-five thousand, six hundred and forty-eight.

(9) Two hundred thirty-four thousand five hundred and sixty-three billions, two hundred and fourteen thousand, three hundred and sixty-two millions, one hundred and fifty-six thousand, six hundred and thirty-four.

(10) Fifty-four trillions, three hundred and twenty-six thousand four hundred and twenty-eight billions, nine hundred and sixteen thousand five hundred and forty-three millions, four hundred and sixty-five thousand, three hundred and forty-six.

(11) Eight hundred and sixty-four trillions, two hundred and fifteen thousand six hundred and forty-two billions, four hundred and sixty-eight millions, four thousand five hundred and sixty-two.

(12) Two quadrillions, one hundred and forty-six thousand, eight hundred and sixty-two trillions, eight hundred and ninety-eight thousand, seven hundred and sixty-four billions, eight hundred and forty-two thousand millions, six hundred and ninety-eight thousand and forty-two.

ADDITION:

Answers.

(1) 36	(2) 675	(3) 5040	(4) 8586
(5) 8460	(6) 7497	(7) 84987	(8) 66726
(9) 63369	(10) 747936	(11) 894861	(12) 1056069

As the proving of addition by the common method requires more time than the teacher can spare for that purpose, I have, in these examples, made every row of figures to end with nine, consequently, the total must do the same if the work be right; and by this method the pupil may be exercised with various other examples, until he is found sufficiently perfect.

Questions Answered.

(1) 34263	(2) 63	(3) 60
53163	8154	30
8172	6201	12
846	99	6
<hr/> 96444	<hr/> 14517	<hr/> 108 pence.

MULTIPLICATION.

3 /

(4) Jan. 31 Feb. 28 March 31 April 30 <hr style="width: 50%; margin: 5px auto;"/> 120 Days. <hr style="width: 50%; margin: 5px auto;"/>	(5) 1787 60 <hr style="width: 50%; margin: 5px auto;"/> 1847 <hr style="width: 50%; margin: 5px auto;"/>	(6) 1787 116 <hr style="width: 50%; margin: 5px auto;"/> 1903 <hr style="width: 50%; margin: 5px auto;"/>
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SUBTRACTION.

Answers.

- | | | |
|------------------|------------------|------------------|
| (1) 74311343522 | (2) 64202661111 | (3) 46574614221 |
| (4) 48775485155 | (5) 32975113221 | (6) 64204197581 |
| (7) 63382135411 | (8) 44463169266 | (9) 35330912534 |
| (10) 46422219863 | (11) 55011074745 | (12) 22108765433 |

Questions answered.

- | | |
|---|---|
| (1) 1808
1746
<hr style="width: 50%; margin: 5px auto;"/> 62 Years. | (2) First $102 - 72 = 30$ Difference.
Then $102 + 72 = 174$ Sum. |
|---|---|

- | | | |
|--|---|--|
| (3) 864952
36842
<hr style="width: 50%; margin: 5px auto;"/> 828110 Less No. | (4) 33905
30624
<hr style="width: 50%; margin: 5px auto;"/> 3281 lbs. | (5) 1808
508
<hr style="width: 50%; margin: 5px auto;"/> 1300 Years. |
| (6) 1808
1066
<hr style="width: 50%; margin: 5px auto;"/> 742 Years. | (7) 1808
1616
<hr style="width: 50%; margin: 5px auto;"/> 192 Years. | |

MULTIPLICATION.

Answers.

- | | |
|-----------------|-----------------|
| (1) 8486429292 | (2) 9370639062 |
| (3) 21848582448 | (4) 31862290815 |
| (5) 14074073676 | (6) 8641974663 |
| (7) 17313883776 | (8) 49335553467 |

MULTIPLICATION.

(9) 62132464530	(10) 45447831495
(11) 25445546064	(12) 40617610956
(13) 78483880467	(14) 87635744856
(15) 204139054440	(16) 295522315974
(17) 134985143979	(18) 305073026784
(19) 98575339824	(20) 172245431448
(21) 232688554038	(22) 267964142976
(23) 106928216424	(24) 184069323018
(25) 1496445909525	(26) 761581139058
(27) 1794031428420	(28) 1991434833828
(29) 20178289657152	(30) 24385207418056
(31) 9794086306128	(32) 25999202980296
(33) 40063332968757	(34) 311528888892783
(35) 145801426277250	(36) 106210797330924
(37) 1065808525174416	(38) 1712262025232208
(39) 12884970983029794	(40) 5445418058704098
(41) 59039041808423727	(42) 59039041808423727

ABBREVIATIONS.

(43) 92545490355113808	(44) 128285168943911427
(45) 290256568722918000	(46) 290256568722918000
(47) 9876543210	(48) 1987654300
(49) 1987654000	(50) 1987650000

BY PARTS.

(51) 1851851835	(52) 10588682025
(53) 11685734244	(54) 35680 89608
(55) 24669754632	(56) 19543780683
(57) 107714868228	(58) 65667128112
(59) 47093779264	(60) 904785002496

DIVISION.

5

Questions Answered.

- (1) $89460 \times 50 = 4473000$.
- (2) $40 \times 5 = 200$.
- (3) $39 \times 20 = 780$ yards.
- (4) $268 \times 118 = 31624$ soldiers.
- (5) $235 \times 45 \times 50 = 528750$ letters.
- (6) $10000 \times 5 = 50000$ persons.
- (7) First $50 \times 50 = 2500$, square of 50; and $100 \times 20 = 2000$; then $2500 - 2000 = 500$, the number required.

DIVISION.

Answers.

- | | |
|---|---|
| (1) 4243214646 | (2) 3123546354 |
| (3) 5462145612 | (4) 6372458163 |
| (5) 2345678946 | (6) 1234567809 |
| (7) 2164235472 | (8) 5481728163 |
| (9) 6213246453 | (10) 4131621045 |
| (11) 2120462172 | (12) 312443161 quo. 2 rem. |
| (13) 341234262$\frac{2}{3}$ | (14) 2434326246 |
| (15) 4536423432 | (16) 5472635481 |
| (17) 2142621333 | (18) 4237125372 |
| (19) 421262136 | (20) 531621702 |
| (21) 546217263 | (22) 728163432 |
| (23) 431162163 | (24) 324637254 |
| (25) 638143245 | (26) 234621423 |
| (27) 423620172 | (28) 542034522 |
| (29) 621405816 | (30) 534620438 |
| (31) 42354637$\frac{4624}{23134}$ | (32) 613854721$\frac{6941}{43354}$ |
| (33) 12345678$\frac{22061}{324513}$ | (34) 98765432$\frac{31542}{313423}$ |

COMPOUND ADDITION.

- (35) 6214232340 (36) 4323241211111111
 (37) 23562043⁹⁰⁴⁶⁸²₄₅₁₃₄₁₃ (38) 315728161⁶²⁸²⁴⁴₅₄₂₃₂₁₆
 (39) 312471423 (40) 478216243
 (41) 123456789

ABBREVIATIONS.

- (42) 230040702 (43) 630702009
 (44) 720203400 (45) 403020270
 (46) 987654321 (47) 19876543
 (48) 1987654 (49) 198765

BY PARTS.

Ex. 50 is worked.

- (51) 324603729 (52) 637146243
 (53) 342635481 (54) 241281243
 (55) 816021729 (56) 456021723
 (57) 420480172 (58) 523602432

Questions answered.

- (1) $4473000 + 89460 = 50\text{L}$.
 (2) $200 + 40 = 5\text{L}$. each man.
 (3) There are 20 pennyworth more of the last sort bought than of the first, and the remainder will fetch but $16d$.; hence $20d. - 16d. = 4d$. loss.
 (4) $31624 + 268 = 118$ men.
 (5) First, $528750 + 50 = 10575$ lines; then $10575 + 45 = 235$ pages.
 (6) $50000 + 5 = 10000$ persons.
 (7) First, $100 \times 20 = 2000$; and $50 \times 50 = 2500$; then $2500 - 2000 = 500$, the number required.

COMPOUND ADDITION.

Answers.

- (1) $\begin{matrix} \text{£} & \text{s.} & \text{d.} \\ 324 & 12 & 6\frac{1}{2} \end{matrix}$ (2) $\begin{matrix} \text{£} & \text{s.} & \text{d.} \\ 354 & 0 & 0\frac{1}{2} \end{matrix}$ (3) $\begin{matrix} \text{£} & \text{s.} & \text{d.} \\ 7666 & 1 & 3 \end{matrix}$

COMPOUND ADDITION.

7

\pounds	s.	d.	\pounds	s.	d.	\pounds	s.	d.
(4) 6461	0	11½	(5) 6477	7	7½	(6) 7216	9	3½
(7) 6807	7	10½	(8) 6024	8	7½	(9) 5997	7	10½
(10) 6015	8	9½	(11) 6824	2	4½	(12) 8922	6	1

TROY WEIGHT.

lb.	oz.	awt.	gr.	lb.	oz.	dwt.	gr.
(13) 486	4	1	0	(14) 413	4	14	21

APOTHECARIES WEIGHT.

lb.	oz.	dr.	sc.	gr.	lb.	oz.	dr.	sc.	gr.
(15) 68	3	1	2	17	(16) 76	2	1	0	15

AVOIRDUPOIS WEIGHT.

T.	C.	qr.	lb.	oz.	dr.	T.	C.	qr.	lb.	oz.	dr.
(17) 69	6	0	12	2	3	(18) 77	9	0	9	15	5

CLOTH MEASURE.

Yds.	qr.	na.	E.Ells	qr.	na.	F.Ells	qr.	na.
(19) 623	1	0	(20) 622	1	3	(21) 817	1	2

LONG MEASURE.

Leag.	mi.	fur.	po.	Yds.	ft.	in.	b.c.
(22) 584	0	4	17	(23) 691	2	9	0

LAND MEASURE.

A.	R.	P.	A.	R.	P.	A.	R.	P.
(24) 583	3	12	(25) 620	0	25	(26) 692	2	35

WINE MEASURE.

T.	hhd.	gal.	qt.	pi.	T.	hhd.	gal.	qt.	pi.
(27) 96	3	46	3	1	(28) 95	3	53	1	0

ALE AND BEER MEASURE.

<i>A.</i>	<i>hhd.</i>	<i>gal.</i>	<i>qt.</i>	<i>pi.</i>		<i>B.</i>	<i>hd.</i>	<i>gal.</i>	<i>qt.</i>	<i>pi.</i>
(29)	582	29	1	1		(30)	613	26	1	1

DRY MEASURE.

Lasts	qrs.	bu.	pec.	gal.	Lasts	qr.	bu.	pec.	gal.
(31) 86	7	2	1	0	(32) 95	0	0	2	1

TIME.

Years	mo.	w.	days	Days	ho.	mi.	sec.
(33) 794	2	0	6	(34) 875	21	46	29

MOTION.

S.	deg.	"	"	S.	deg.	"	"	"
(35) 107	9	56	18	(36) 95	1	11	52	22

COMPOUND ADDITION.

SQUARE MEASURE.

	Yds.	ft.	inch.		Yds.	ft.	inch.
(37)	1091	6	114	(38)	1015	6	104

SOLID MEASURE.

	Yds.	ft.	inch.		Yds.	ft.	inch.
(39)	855	10	671	(40)	970	18	749

Questions answered.

(1)				(2)			
	£	s.	d.		£	s.	d.
Recd. of A	27	1	4	Wheat	23	12	6
B	12	6	8½	Rye	16	4	2
C	31	12	8	Oats	20	0	6
D	42	14	8½	Barley	38	14	6½
E	82	4	2	Car.	1	6	0
F	41	16	3½	Commis.	3	10	6
Answer	237	15	10½	sum recd.	103	8	2½ ans.

(3)				(4)			
	£	s.	d.		£	s.	d.
Paid in part	30	10	6	Officers	394	12	6
Remains unpaid	42	2	4	Receive	240	0	0
Answer	72	12	10	Answer	634	12	6

(5)				(6)			
	£	s.	d.		£	s.	d.
First cost	58	0	0	Rent	30	0	0
Packing	0	10	6	Window lights	0	18	10½
Carriage	1	7	0	Poor's rates	10	0	0
Spent	0	6	8	Lamps, &c.	2	2	0
Answer	60	4	2	Answer	43	0	10½

COMPOUND SUBTRACTION.

Answers.

<i>£</i>	<i>s.</i>	<i>d.</i>	<i>£</i>	<i>s.</i>	<i>d.</i>	<i>£</i>	<i>s.</i>	<i>d.</i>
(1) 23	6	2½	(2) 17	6	3½	(3) 15	7	5½
(4) 21	11	9½	(5) 41	9	3½	(6) 18	1	11½
(7) 17	17	10½	(8) 26	18	6½			

TROY WEIGHT.

<i>lb.</i>	<i>oz.</i>	<i>dwt.</i>	<i>grs.</i>	<i>lb.</i>	<i>oz.</i>	<i>dwt.</i>	<i>grs.</i>
(9) 72	2	9	9	(10) 46	3	7	4
(11) 74	9	17	4	(12) 73	1	12	9

APOTHECARIES WEIGHT.

<i>lb.</i>	<i>oz.</i>	<i>dr.</i>	<i>sc.</i>	<i>grs.</i>	<i>lb.</i>	<i>oz.</i>	<i>dr.</i>	<i>sc.</i>	<i>grs.</i>
(13) 55	1	3	1	6	(14) 19	5	4	1	3
(15) 42	1	4	1	2	(16) 15	5	3	1	12

AVOIRDUPOIS WEIGHT.

<i>T.</i>	<i>C.</i>	<i>qr.</i>	<i>lb.</i>	<i>oz.</i>	<i>dr.</i>	<i>T.</i>	<i>C.</i>	<i>qr.</i>	<i>lb.</i>	<i>oz.</i>	<i>dr.</i>
(17) 4	6	1	3	2	4	(18) 3	17	2	5	1	4
(19) 8	4	1	12	13	14	(20) 3	5	1	15	5	6

CLOTH MEASURE.

<i>Yds.</i>	<i>qr.</i>	<i>na.</i>	<i>E.E.</i>	<i>qr.</i>	<i>na.</i>	<i>F.E.</i>	<i>qr.</i>	<i>na.</i>
(21) 33	2	1	(22) 33	1	2	(23) 29	0	1
(24) 25	2	1	(25) 15	0	2	(26) 3	0	2

LONG MEASURE.

<i>Leag.</i>	<i>mi.</i>	<i>fur.</i>	<i>po.</i>	<i>Yds.</i>	<i>ft.</i>	<i>in.</i>	<i>b.</i>	<i>c.</i>
(27) 44	1	2	15	(28) 33	1	2	1	
(29) 19	1	1	14	(30) 47	0	1	2	

LAND MEASURE.

<i>A.</i>	<i>R.</i>	<i>P.</i>	<i>A.</i>	<i>R.</i>	<i>P.</i>	<i>A.</i>	<i>R.</i>	<i>P.</i>
(31) 66	2	17	(32) 27	2	11	(33) 29	2	22
(34) 20	0	28	(35) 18	2	11	(36) 76	0	1

WINE MEASURE.

<i>T.</i>	<i>hhd.</i>	<i>gal.</i>	<i>qt.</i>	<i>pi.</i>	<i>T.</i>	<i>hhd.</i>	<i>gal.</i>	<i>qt.</i>	<i>pi.</i>
(37) 3	2	29	2	1	(38) 4	2	13	1	1
(39) 2	2	12	1	1	(40) 3	0	0	1	0

COMPOUND SUBTRACTION.

ALE AND BEER MEASURE.

	<i>A. hhd. gal.</i>	<i>qt.</i>	<i>pi.</i>
(41)	11	24	1 1
(43)	2	1	0 1

	<i>A hhd. gal.</i>	<i>qt.</i>	<i>pi.</i>
(42)	28	28	3 1
(44)	49	31	1 1

DRY MEASURE.

	<i>Lasts</i>	<i>qr.</i>	<i>bu.</i>	<i>pec.</i>	<i>gal.</i>
(45)	4	2	3	1	1
(47)	2	5	2	3	1

	<i>Lasts</i>	<i>qr.</i>	<i>bu.</i>	<i>pec.</i>	<i>gal.</i>
(46)	5	7	3	2	1
(48)	3	2	1	2	1

TIME.

	<i>Years</i>	<i>mo.</i>	<i>w.</i>	<i>days.</i>
(49)	62	7	2	3
(51)	26	3	2	4

	<i>Days</i>	<i>ho.</i>	<i>mi.</i>	<i>sec.</i>
(50)	43	8	33	16
(52)	44	13	19	25

MOTION.

	<i>s.</i>	<i>o</i>	<i>'</i>	<i>"</i>	<i>'''</i>
(53)	5	4	15	30	5
(55)	3	13	27	34	35

	<i>s.</i>	<i>o</i>	<i>'</i>	<i>"</i>	<i>'''</i>
(54)	4	15	27	9	36
(56)	4	16	33	37	8

SQUARE MEASURE.

	<i>Yds.</i>	<i>ft.</i>	<i>inch.</i>
(57)	30	2	115
(59)	24	5	22

	<i>Yds.</i>	<i>ft.</i>	<i>inch.</i>
(58)	67	4	73
(60)	33	5	36

SOLID MEASURE.

	<i>Yds.</i>	<i>ft.</i>	<i>inch.</i>
(61)	2	13	233
(63)	4	6	658

	<i>Yds.</i>	<i>ft.</i>	<i>inch.</i>
(62)	2	11	472
(64)	5	2	12

Questions Answered.

	<i>£</i>	<i>s.</i>	<i>d.</i>
From	86	0	6½
Take	31	18	11
Differ.	54	1	7½

	<i>£</i>	<i>s.</i>	<i>d.</i>
Lent	200	0	0
Recd. by goods	84	6	4
Remains due	115	13	8

	<i>£</i>	<i>s.</i>	<i>d.</i>
From	18308		1508
Take	2118		+610
Diff.	16190		2118

	<i>£</i>	<i>s.</i>	<i>d.</i>
House & furniture	1100	8	4½
House	742	10	6
Furniture cost	357	17	10½

COMPOUND MULTIPLICATION.

11

(5)		<i>Years</i>	<i>m.</i>	<i>w.</i>	<i>d.</i>	<i>h.</i>	<i>m.</i>
	From	21	0	0	0	0	0
	Take	14	12	11	10	9	8
		<hr/>					
To serve		5	10	3	3	14	52 Ans.

<i>Debtor</i>				(6)	<i>Creditor</i>			
	£	s.	d.			£	s.	d.
To	A.	86	10	6	By cash	10	0	0
	B.	36	0	0	Commodities	21	12	0
	C.	20	12	4½	Housh. furniture	42	0	6
	D.	56	18	0	Book debts	62	13	6
	E.	10	10	3	Plate	12	4	4
	F.	86	8	6				
<hr/>						<hr/>		
Debtor	296	19	7½			148	10	4
Creditor	148	10	4			<hr/>		
<hr/>								
Answer	148	9	3½					

COMPOUND MULTIPLICATION.

<i>Answers.</i>			
£	s.	d.	
(1) 0	16	4	
		3	
<hr/>			
Ans.	2	9	0
<hr/>			
(4) 0	0	7½	
		6	
<hr/>			
	0	3	9
<hr/>			
(7) 0	1	9	
		9	
<hr/>			
	0	15	9
<hr/>			
(2) 0	7	3	
		4	
<hr/>			
	1	9	0
<hr/>			
(5)	9	6	
		7	
<hr/>			
	3	6	6
<hr/>			
(8) 0	2	2½	
		10	
<hr/>			
	1	2	1
<hr/>			
(3) 0	1	2	
		5	
<hr/>			
	0	5	10
<hr/>			
(6) 0	2	4	
		8	
<hr/>			
	0	18	8
<hr/>			
(9) 2	1	4	
		11	
<hr/>			
	22	14	8
<hr/>			

$$\begin{array}{r}
 \text{(10)} \quad \begin{array}{r} \text{£} \quad \text{s.} \quad \text{d.} \\ 1 \quad 4 \quad 3 \\ 12 \\ \hline 14 \quad 11 \quad 0 \\ \hline \end{array}
 \end{array}$$

$$\begin{array}{r}
 \text{(11)} \quad \begin{array}{r} \text{£} \quad \text{s.} \quad \text{d.} \\ 0 \quad 17 \quad 6 \\ 2 \times 7 = 14 \\ \hline 1 \quad 15 \quad 0 \\ 7 \\ \hline 12 \quad 5 \quad 0 \\ \hline \end{array}
 \end{array}$$

$$\begin{array}{r}
 \text{(12)} \quad \begin{array}{r} \text{£} \quad \text{s.} \quad \text{d.} \\ 7 \quad 10\frac{1}{2} \\ 3 \times 5 = 15 \\ \hline 1 \quad 3 \quad 7\frac{1}{2} \\ 5 \\ \hline 5 \quad 18 \quad 1\frac{1}{2} \\ \hline \end{array}
 \end{array}$$

$$\begin{array}{r}
 \text{(13)} \quad \begin{array}{r} \text{£} \quad \text{s.} \\ 1 \quad 7 \\ 4 \times 4 = 16 \\ \hline 5 \quad 8 \\ 4 \\ \hline 21 \quad 12 \\ \hline \end{array}
 \end{array}$$

	<i>Sums.</i>			<i>Multipliers.</i>		<i>Products.</i>		
	£	s.	d.			£	s.	d.
(14)	0	17	6	$\times 3 \times 6$	=	15	15	0
(15)	1	18	8	$\times 4 \times 5$	=	38	13	4
(16)		5	$7\frac{1}{2}$	$\times 3 \times 7$	=	5	18	$1\frac{1}{2}$
(17)	5	11	4	$\times 2 \times 11$	=	122	9	4
(18)	4	7	2	$\times 4 \times 6$	=	104	12	0
(19)		4	6	$\times 5 \times 5$	=	5	12	6
(20)		5	$11\frac{1}{2}$	$\times 3 \times 9$	=	8	0	$10\frac{1}{2}$
(21)		2	8	$\times 4 \times 7$	=	3	14	8
(22)	1	12	0	$\times 6 \times 5$	=	48	0	0
(23)		1	9	$\times 4 \times 8$	=	2	16	0
(24)	1	2	0	$\times 3 \times 11$	=	36	6	0
(25)	1	2	6	$\times 5 \times 7$	=	39	7	6
(26)		6	$2\frac{1}{2}$	$\times 6 \times 6$	=	11	3	6
(27)	1	12	6	$\times 5 \times 8$	=	65	0	0
(28)		6	$4\frac{1}{2}$	$\times 6 \times 7$	=	13	7	9

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	<i>Sums. Multipliers.</i>				<i>Products.</i>		
	£	s.	d.		£	s.	d.
(29)	19	10		$\times 4 \times 11 =$	43	12	8
(30)	19	4		$\times 5 \times 9 =$	43	10	0
(31)	3	7		$\times 6 \times 8 =$	8	12	0
(32)	2	5½		$\times 5 \times 10 =$	6	2	11
(33)	1	16		$\times 6 \times 9 =$	98	11	0
(34)	1	10	0	$\times 5 \times 11 =$	82	10	0
(35)	1	2	6	$\times 7 \times 8 =$	63	0	0
(36)		6	9	$\times 6 \times 10 =$	20	5	0
(37)		4	3	$\times 7 \times 9 =$	13	7	9
(38)		4	8	$\times 8 \times 8 =$	14	18	8
(39)		1	6½	$\times 6 \times 11 =$	5	1	9
(40)		1	4	$\times 7 \times 10 =$	4	13	4
(41)		1	8	$\times 8 \times 9 =$	6	0	0
(42)		3	2¼	$\times 7 \times 11 =$	12	5	5½
(43)		3	6	$\times 8 \times 10 =$	14	0	0
(44)		0	7½	$\times 9 \times 9 =$	2	10	7½
(45)	21	4	6	$\times 7 \times 12 =$	1782	18	0
(46)		4	6	$\times 8 \times 11 =$	19	16	0
(47)		6	0	$\times 10 \times 9 =$	27	0	0
(48)	2	10	0	$\times 8 \times 12 =$	240	0	0
(49)	8	10	0	$\times 9 \times 11 =$	841	10	0
(50)		17	0	$\times 10 \times 10 =$	85	0	0
(51)		5	6	$\times 9 \times 12 =$	29	14	0
(52)		1	10	$\times 10 \times 11 =$	10	1	8
(53)		2	8	$\times 10 \times 12 =$	16	0	0
(54)		1	2	$\times 11 \times 11 =$	7	1	2
(55)		2	4	$\times 11 \times 12 =$	15	8	0
(56)		2	2	$\times 12 \times 12 =$	15	12	0
(57)		0	4¼	$\times 8 \times 7 \times 2 =$	1	19	8
(58)		0	3½	$\times 8 \times 7 \times 4 =$	3	5	4

	Sums.			Multipliers.		Products.		
	£	s.	d.			£	s.	d.
(59)		0	5½	× 8 × 7 × 6	=	7	14	0
(60)		5	4	× 10 × 9 × 4	=	96	0	0
(61)		1	4	× 8 × 7 × 10	=	37	6	8
(62)	1	2	2	× 12 × 12 × 12	=	1915	4	0
(63)		5	6	× 4 × 4 + 1	=	4	13	6
(64)		3	6	× 3 × 7 + 2	=	4	0	6
(65)	14	6	6	× 4 × 7 + 1	=	21	0	6
(66)		3	6	× 5 × 7 - 1	=	5	19	0
(67)		0	9	× 6 × 6 + 1	=	1	7	9
(68)		2	2	× 6 × 7 + 1	=	4	13	2
(69)	12	6½	5	× 8 - 1	=	24	9	1½
(70)	1	6½	5	× 9 + 2	=	3	12	5½
(71)		0	9	× 6 × 9 - 1	=	1	19	9
(72)		6	6	× 6 × 10 - 1	=	19	3	6
(73)		1	8	× 7 × 10 + 1	=	5	18	4
(74)		4	8	× 9 × 9 + 2	=	19	7	4
(75)		6	8	× 8 × 11 + 1	=	29	13	4
(76)		6	8	× 8 × 12 + 1	=	32	6	8
(77)		8	2	× 9 × 12 - 2	=	43	5	8
(78)	10	2	2	× 9 × 12 + 1	=	55	8	2
(79)		5	6½	× 11 × 11 + 2	=	34	1	7½
(80)	1	3	2	× 12 × 12 + 1	=	167	19	2
(81)		0	9	× 5 × 5 + ½	=	0	18	11½
(82)		2	4½	× 5 × 6 + ½	=	3	12	5½
(83)	1	10	6	× 5 × 7 + ½	=	54	10	4½
(84)	32	2	6	× 5 × 8 + ½	=	1301	1	3
(85)	2	12	0	× 8 × 8 + ¼	=	167	1	0
(86)	1	4	0	× 9 × 9 + ½	=	97	16	0
(87)		2	4	× 9 × 12 + ¼	=	12	12	7
(88)		6	8½	× 12 × 10 + ½	=	40	8	4½

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	<i>Sums.</i>			<i>Multipliers.</i>		<i>Products.</i>		
	£	s.	d.			£	s.	d.
(89)		1	4	$\times 12 \times 11 + \frac{1}{4} =$		8	16	4
(90)		9	2	$\times 12 \times 12 + \frac{1}{2} =$		66	4	7
(91)	1	5	6	$\times 10 \times 11 + 7\frac{1}{4} =$		149	9	10 $\frac{1}{2}$
(92)		12	9 $\frac{1}{2}$	$\times 12 \times 12 + 1\frac{1}{2} =$		93	1	2 $\frac{1}{4}$
(93)	1	4	10 $\frac{1}{4}$	$\times 10 \times 9 \times 4 + 5 =$		453	11	9 $\frac{1}{4}$
(94)	362	10	6 $\frac{1}{2}$	$\times 12 + 1\frac{1}{4} =$		4894	2	3 $\frac{1}{2}$
(95)	4	4	3 $\frac{1}{4}$	$\times 10 \times 10 \times 10 \times 9 + 652 =$		40669	2	1
(96)	3	2	6 $\frac{1}{4}$	$\times 10 \times 9 \times 4 + 5 =$	£ s. d.	1141	0	1 $\frac{1}{4}$ ann.ex.
						2264	0	0 yly. in.
						1122	19	10 $\frac{1}{4}$ helaysup.

	<i>Cwt.</i>	<i>gr.</i>	<i>lb.</i>	<i>oz.</i>	<i>dr.</i>		<i>Cwt.</i>	<i>gr.</i>	<i>lb.</i>	<i>oz.</i>	<i>dr.</i>
(97)	14	0	21	0	14	$\times 7 =$	99	1	7	6	2
	<i>lb.</i>	<i>oz.</i>	<i>dr.</i>	<i>sc.</i>	<i>gr.</i>		<i>lb.</i>	<i>oz.</i>	<i>dr.</i>	<i>sc.</i>	<i>gr.</i>
(98)	10	6	4	1	17	$\times 9 =$	94	11	1	1	13
	<i>Cwt.</i>	<i>gr.</i>	<i>lb.</i>				<i>Cwt.</i>	<i>gr.</i>	<i>lb.</i>		
(99)	8	1	21	$\times 6 \times 6 + 1 =$			312	0	21		
(100)	9	1	12	$\times 9 \times 12 + 1 =$			1019	3	20		
	<i>lb.</i>	<i>oz.</i>	<i>dwt.</i>	<i>grs.</i>			<i>lb.</i>	<i>oz.</i>	<i>dwt.</i>	<i>grs.</i>	
(101)	4	6	8	$\times 4 =$			18	1	12	12	

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	<i>Answers.</i>				<i>Answers.</i>				<i>Answers.</i>		
	£	s.	d.		£	s.	d.		£	s.	d.
(1)	3)2	9	0	(2)	4)1	9	0	(3)	5)0	5	10
Ans.	0	16	4		0	7	3		0	1	2
(4)	6)0	3	9	(5)	7)3	6	6	(6)	8)0	18	8
	0	0	7 $\frac{1}{2}$		0	9	6		0	2	4

$$\begin{array}{r}
 \text{(7)} \quad \begin{array}{r} \text{£} \quad \text{s.} \quad \text{d.} \\ 9) 0 \ 15 \ 9 \\ \hline 0 \ 1 \ 9 \\ \hline \end{array}
 \end{array}
 \quad
 \begin{array}{r}
 \text{(8)} \quad \begin{array}{r} \text{£} \quad \text{s.} \quad \text{d.} \\ 10) 1 \ 2 \ 1 \\ \hline 0 \ 2 \ 2\frac{1}{2} \\ \hline \end{array}
 \end{array}
 \quad
 \begin{array}{r}
 \text{(9)} \quad \begin{array}{r} \text{£} \quad \text{s.} \quad \text{d.} \\ 11) 22 \ 14 \ 8 \\ \hline 2 \ 1 \ 4 \\ \hline \end{array}
 \end{array}$$

$$\begin{array}{r}
 \text{(10)} \quad \begin{array}{r} \text{£} \quad \text{s.} \quad \text{d.} \\ 12) 14 \ 11 \ 0 \\ \hline 1 \ 4 \ 3 \\ \hline \end{array}
 \end{array}
 \quad
 \begin{array}{r}
 \text{(11)} \quad \begin{array}{r} \text{£} \quad \text{s.} \quad \text{d.} \\ 14 \left\{ \begin{array}{l} 7) 12 \ 5 \ 0 \\ 2) 1 \ 15 \ 0 \end{array} \right. \\ \hline 0 \ 17 \ 6 \\ \hline \end{array}
 \end{array}
 \quad
 \begin{array}{r}
 \text{(12)} \quad \begin{array}{r} \text{£} \quad \text{s.} \quad \text{d.} \\ 15 \left\{ \begin{array}{l} 5) 5 \ 18 \ 1\frac{1}{2} \\ 3) 1 \ 3 \ 7\frac{1}{2} \end{array} \right. \\ \hline 0 \ 7 \ 10\frac{1}{2} \\ \hline \end{array}
 \end{array}$$

$$\begin{array}{r}
 \text{(13)} \quad \begin{array}{r} \text{£} \quad \text{s.} \quad \text{d.} \\ 16 \left\{ \begin{array}{l} 4) 21 \ 12 \ 0 \\ 4) 5 \ 8 \ 0 \end{array} \right. \\ \hline 1 \ 7 \ 0 \\ \hline \end{array}
 \end{array}
 \quad
 \begin{array}{r}
 \text{(14)} \quad \begin{array}{r} \text{£} \quad \text{s.} \quad \text{d.} \\ 18 \left\{ \begin{array}{l} 6) 15 \ 15 \ 0 \\ 3) 2 \ 12 \ 6 \end{array} \right. \\ \hline 0 \ 17 \ 6 \\ \hline \end{array}
 \end{array}$$

$$\begin{array}{r}
 \text{(15)} \quad \begin{array}{r} \text{£} \quad \text{s.} \quad \text{d.} \\ 20 \left\{ \begin{array}{l} 5) 38 \ 13 \ 4 \\ 4) 7 \ 14 \ 8 \end{array} \right. \\ \hline 1 \ 18 \ 8 \\ \hline \end{array}
 \end{array}
 \quad
 \begin{array}{r}
 \text{(16)} \quad \begin{array}{r} \text{£} \quad \text{s.} \quad \text{d.} \\ 21 \left\{ \begin{array}{l} 7) 5 \ 18 \ 1\frac{1}{2} \\ 3) 0 \ 16 \ 10\frac{1}{2} \end{array} \right. \\ \hline 0 \ 5 \ 7\frac{1}{2} \\ \hline \end{array}
 \end{array}$$

$$\begin{array}{r}
 \text{(17)} \quad \begin{array}{r} \text{£} \quad \text{s.} \quad \text{d.} \\ 22 \left\{ \begin{array}{l} 11) 122 \ 9 \ 4 \\ 2) 11 \ 2 \ 8 \end{array} \right. \\ \hline 5 \ 11 \ 4 \\ \hline \end{array}
 \end{array}
 \quad
 \begin{array}{r}
 \text{(18)} \quad \begin{array}{r} \text{£} \quad \text{s.} \quad \text{d.} \\ 24 \left\{ \begin{array}{l} 6) 104 \ 12 \ 0 \\ 4) 17 \ 8 \ 8 \end{array} \right. \\ \hline 4 \ 7 \ 2 \\ \hline \end{array}
 \end{array}$$

$$\begin{array}{r}
 \text{(19)} \quad \begin{array}{r} \text{£} \quad \text{s.} \quad \text{d.} \\ 25 \left\{ \begin{array}{l} 5) 5 \ 12 \ 6 \\ 5) 1 \ 2 \ 6 \end{array} \right. \\ \hline 0 \ 4 \ 6 \\ \hline \end{array}
 \end{array}
 \quad
 \begin{array}{r}
 \text{(20)} \quad \begin{array}{r} \text{£} \quad \text{s.} \quad \text{d.} \\ 27 \left\{ \begin{array}{l} 9) 8 \ 0 \ 10\frac{1}{2} \\ 3) 0 \ 17 \ 10\frac{1}{2} \end{array} \right. \\ \hline 0 \ 5 \ 11\frac{1}{2} \\ \hline \end{array}
 \end{array}$$

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$$(21) \quad 28 \left\{ \begin{array}{l} 7) \overset{\text{£}}{3} \overset{\text{s.}}{14} \overset{\text{d.}}{8} \\ (4) \underline{0 \ 10 \ 8} \\ \underline{0 \ 2 \ 8} \end{array} \right.$$

$$(22) \quad 30 \left\{ \begin{array}{l} 5) \overset{\text{£}}{48} \overset{\text{s.}}{0} \overset{\text{d.}}{0} \\ (6) \underline{9 \ 12 \ 0} \\ \underline{1 \ 12 \ 0} \end{array} \right.$$

$$(23) \quad 32 \left\{ \begin{array}{l} 8) \overset{\text{£}}{2} \overset{\text{s.}}{16} \overset{\text{d.}}{0} \\ (4) \underline{0 \ 7 \ 0} \\ \underline{0 \ 1 \ 9} \end{array} \right.$$

$$(24) \quad 33 \left\{ \begin{array}{l} 11) \overset{\text{£}}{36} \overset{\text{s.}}{6} \overset{\text{d.}}{0} \\ (3) \underline{3 \ 6 \ 0} \\ \underline{1 \ 2 \ 0} \end{array} \right.$$

$$(25) \quad 35 \left\{ \begin{array}{l} 7) \overset{\text{£}}{39} \overset{\text{s.}}{7} \overset{\text{d.}}{6} \\ (5) \underline{5 \ 12 \ 6} \\ \underline{1 \ 2 \ 6} \end{array} \right.$$

$$(26) \quad 36 \left\{ \begin{array}{l} 6) \overset{\text{£}}{11} \overset{\text{s.}}{3} \overset{\text{d.}}{6} \\ (6) \underline{1 \ 17 \ 3} \\ \underline{0 \ 6 \ 2\frac{1}{2}} \end{array} \right.$$

$$(27) \quad 40 \left\{ \begin{array}{l} 8) \overset{\text{£}}{65} \overset{\text{s.}}{0} \overset{\text{d.}}{0} \\ (5) \underline{8 \ 2 \ 6} \\ \underline{1 \ 12 \ 6} \end{array} \right.$$

$$(28) \quad 42 \left\{ \begin{array}{l} 7) \overset{\text{£}}{13} \overset{\text{s.}}{7} \overset{\text{d.}}{9} \\ (6) \underline{1 \ 18 \ 3} \\ \underline{0 \ 6 \ 4\frac{1}{2}} \end{array} \right.$$

$$(29) \quad 44 \left\{ \begin{array}{l} 11) \overset{\text{£}}{43} \overset{\text{s.}}{12} \overset{\text{d.}}{8} \\ (4) \underline{3 \ 19 \ 4} \\ \underline{0 \ 19 \ 10} \end{array} \right.$$

$$(30) \quad 45 \left\{ \begin{array}{l} 9) \overset{\text{£}}{43} \overset{\text{s.}}{10} \overset{\text{d.}}{0} \\ (5) \underline{4 \ 16 \ 8} \\ \underline{0 \ 19 \ 4} \end{array} \right.$$

$$(31) \quad 48 \left\{ \begin{array}{l} 8) \overset{\text{£}}{8} \overset{\text{s.}}{12} \overset{\text{d.}}{0} \\ (6) \underline{1 \ 1 \ 6} \\ \underline{0 \ 3 \ 7} \end{array} \right.$$

$$(32) \quad 50 \left\{ \begin{array}{l} 10) \overset{\text{£}}{6} \overset{\text{s.}}{2} \overset{\text{d.}}{11} \\ (5) \underline{0 \ 12 \ 3\frac{1}{2}} \\ \underline{0 \ 2 \ 5\frac{1}{2}} \end{array} \right.$$

$$(33) \quad 54 \left\{ \begin{array}{r} \text{£} \quad \text{s.} \quad \text{d.} \\ 9) 98 \quad 11 \quad 0 \\ \hline 6) 10 \quad 19 \quad 0 \\ \hline 1 \quad 16 \quad 6 \end{array} \right.$$

$$(34) \quad 55 \left\{ \begin{array}{r} \text{£} \quad \text{s.} \quad \text{d.} \\ 11) 82 \quad 10 \quad 0 \\ \hline 5) 7 \quad 10 \quad 0 \\ \hline 1 \quad 10 \quad 0 \end{array} \right.$$

$$(35) \quad 56 \left\{ \begin{array}{r} 8) 63 \quad 0 \quad 0 \\ \hline 7) 7 \quad 17 \quad 6 \\ \hline 1 \quad 2 \quad 6 \end{array} \right.$$

$$(36) \quad 60 \left\{ \begin{array}{r} 10) 20 \quad 5 \quad 0 \\ \hline 6) 2 \quad 0 \quad 6 \\ \hline 0 \quad 6 \quad 9 \end{array} \right.$$

$$(37) \quad 63 \left\{ \begin{array}{r} 9) 13 \quad 7 \quad 9 \\ \hline 7) 1 \quad 9 \quad 9 \\ \hline 0 \quad 4 \quad 3 \end{array} \right.$$

$$(38) \quad 64 \left\{ \begin{array}{r} 8) 14 \quad 18 \quad 8 \\ \hline 8) 1 \quad 17 \quad 4 \\ \hline 0 \quad 4 \quad 8 \end{array} \right.$$

$$(39) \quad 66 \left\{ \begin{array}{r} 11) 5 \quad 1 \quad 9 \\ \hline 6) 0 \quad 9 \quad 3 \\ \hline 0 \quad 1 \quad 6\frac{1}{2} \end{array} \right.$$

$$(40) \quad 70 \left\{ \begin{array}{r} 10) 4 \quad 13 \quad 4 \\ \hline 7) 0 \quad 9 \quad 4 \\ \hline 0 \quad 1 \quad 4 \end{array} \right.$$

$$(41) \quad 72 \left\{ \begin{array}{r} 9) 6 \quad 0 \quad 0 \\ \hline 8) 0 \quad 13 \quad 4 \\ \hline 0 \quad 1 \quad 8 \end{array} \right.$$

$$(42) \quad 77 \left\{ \begin{array}{r} 11) 12 \quad 5 \quad 5\frac{1}{2} \\ \hline 7) 1 \quad 2 \quad 3\frac{3}{4} \\ \hline 0 \quad 3 \quad 2\frac{1}{4} \end{array} \right.$$

$$(43) \quad 80 \left\{ \begin{array}{r} 10) 14 \quad 0 \quad 0 \\ \hline 8) 1 \quad 8 \quad 0 \\ \hline 0 \quad 3 \quad 6 \end{array} \right.$$

$$(44) \quad 81 \left\{ \begin{array}{r} 9) 2 \quad 10 \quad 7\frac{1}{2} \\ \hline 9) 0 \quad 5 \quad 7\frac{1}{2} \\ \hline 0 \quad 0 \quad 7\frac{1}{2} \end{array} \right.$$

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$$(45) \quad 84 \left\{ \begin{array}{r} \overset{\text{£}}{12} \overset{\text{s.}}{17} \overset{\text{d.}}{82} \quad 18 \quad 0 \\ \hline 7) \quad 148 \quad 11 \quad 6 \\ \hline \quad 21 \quad 4 \quad 6 \\ \hline \end{array} \right.$$

$$(46) \quad 88 \left\{ \begin{array}{r} \overset{\text{£}}{11} \overset{\text{s.}}{19} \overset{\text{d.}}{16} \quad 0 \\ \hline 8) \quad 1 \quad 16 \quad 0 \\ \hline \quad 0 \quad 4 \quad 6 \\ \hline \end{array} \right.$$

$$(47) \quad 90 \left\{ \begin{array}{r} 9) 27 \quad 0 \quad 0 \\ \hline 10) 3 \quad 0 \quad 0 \\ \hline \quad 0 \quad 6 \quad 0 \\ \hline \end{array} \right.$$

$$(48) \quad 96 \left\{ \begin{array}{r} 12) 240 \quad 0 \quad 0 \\ \hline 8) 20 \quad 0 \quad 0 \\ \hline \quad 2 \quad 10 \quad 0 \\ \hline \end{array} \right.$$

$$(49) \quad 99 \left\{ \begin{array}{r} 11) 841 \quad 10 \quad 0 \\ \hline 9) 76 \quad 10 \quad 0 \\ \hline \quad 8 \quad 10 \quad 0 \\ \hline \end{array} \right.$$

$$(50) \quad 100 \left\{ \begin{array}{r} 10) 85 \quad 0 \quad 0 \\ \hline 10) 8 \quad 10 \quad 0 \\ \hline \quad 0 \quad 17 \quad 0 \\ \hline \end{array} \right.$$

$$(51) \quad 108 \left\{ \begin{array}{r} 12) 29 \quad 14 \quad 0 \\ \hline 9) 2 \quad 9 \quad 6 \\ \hline \quad 0 \quad 5 \quad 6 \\ \hline \end{array} \right.$$

$$(52) \quad 110 \left\{ \begin{array}{r} 11) 10 \quad 1 \quad 8 \\ \hline 10) 0 \quad 18 \quad 4 \\ \hline \quad 0 \quad 1 \quad 10 \\ \hline \end{array} \right.$$

$$(53) \quad 120 \left\{ \begin{array}{r} 12) 16 \quad 0 \quad 0 \\ \hline 10) 1 \quad 6 \quad 8 \\ \hline \quad 0 \quad 2 \quad 8 \\ \hline \end{array} \right.$$

$$(54) \quad 121 \left\{ \begin{array}{r} 11) 7 \quad 1 \quad 2 \\ \hline 11) 0 \quad 12 \quad 10 \\ \hline \quad 0 \quad 1 \quad 2 \\ \hline \end{array} \right.$$

$$(55) \quad 132 \left\{ \begin{array}{r} 12) 15 \quad 8 \quad 0 \\ \hline 11) 1 \quad 5 \quad 8 \\ \hline \quad 0 \quad 2 \quad 4 \\ \hline \end{array} \right.$$

$$(56) \quad 144 \left\{ \begin{array}{r} 12) 15 \quad 12 \quad 0 \\ \hline 12) 1 \quad 6 \quad 0 \\ \hline \quad 0 \quad 2 \quad 2 \\ \hline \end{array} \right.$$

$$(57) \quad \begin{array}{r} \text{£} \quad \text{s.} \quad \text{d.} \\ 112 \left\{ \begin{array}{l} 2) \overline{1 \ 19 \ 8} \\ 7) \overline{0 \ 19 \ 10} \\ 8) \overline{0 \ 2 \ 10} \\ \hline 0 \ 0 \ 4\frac{1}{4} \end{array} \right. \end{array}$$

$$(58) \quad \begin{array}{r} \text{£} \quad \text{s.} \quad \text{d.} \\ 224 \left\{ \begin{array}{l} 4) \overline{3 \ 5 \ 4} \\ 7) \overline{0 \ 16 \ 4} \\ 8) \overline{0 \ 2 \ 4} \\ \hline 0 \ 0 \ 3\frac{1}{2} \end{array} \right. \end{array}$$

$$(59) \quad \begin{array}{r} 336 \left\{ \begin{array}{l} 6) \overline{7 \ 14 \ 0} \\ 7) \overline{1 \ 5 \ 8} \\ 8) \overline{0 \ 3 \ 8} \\ \hline 0 \ 0 \ 5\frac{1}{2} \end{array} \right. \end{array}$$

$$(60) \quad \begin{array}{r} 360 \left\{ \begin{array}{l} 4) \overline{96 \ 0 \ 0} \\ 9) \overline{24 \ 0 \ 0} \\ 10) \overline{2 \ 13 \ 4} \\ \hline 0 \ 5 \ 4 \end{array} \right. \end{array}$$

$$(61) \quad \begin{array}{r} 560 \left\{ \begin{array}{l} 10) \overline{37 \ 6 \ 8} \\ 7) \overline{3 \ 14 \ 8} \\ 8) \overline{0 \ 10 \ 8} \\ \hline 0 \ 1 \ 4 \end{array} \right. \end{array}$$

$$(62) \quad \begin{array}{r} 1728 \left\{ \begin{array}{l} 12) \overline{1915 \ 4 \ 0} \\ 12) \overline{159 \ 12 \ 0} \\ 12) \overline{13 \ 6 \ 0} \\ \hline 1 \ 2 \ 2 \end{array} \right. \end{array}$$

$$(63) \quad \begin{array}{r} 70 \left\{ \begin{array}{l} \text{£} \quad \text{s.} \quad \text{d.} \\ 10) \overline{4 \ 13 \ 6} \\ 7) \overline{0 \ 9 \ 4\frac{2}{5}} \\ \hline 0 \ 1 \ 4\frac{2}{35} \end{array} \right. \end{array}$$

COMPOUND DIVISION.

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$$\begin{array}{r}
 \text{(64)} \quad \begin{array}{r} \text{£} \quad \text{s.} \quad \text{d.} \\ 4 \quad 0 \quad 6 \\ \hline 20 \\ \hline 23) 80 (3 \quad 6 \text{ Ans} \\ 69 \\ \hline 11 \\ 12 \\ \hline 23) 138 (6 \\ 138 \\ \hline \end{array}
 \end{array}$$

$$\begin{array}{r}
 \text{(65)} \quad \begin{array}{r} \text{£} \quad \text{s.} \quad \text{d.} \\ 21 \quad 0 \quad 6 \\ \hline 20 \\ \hline 29) 420 (14 \quad 6 \text{ Ans.} \\ 406 \\ \hline 14 \\ 12 \\ \hline 29) 174 (6 \\ 174 \\ \hline \end{array}
 \end{array}$$

	£	s.	d.		£	s.	d.	
(66)	5	19	0	÷ 34 =	0	3	6	Ans.
(67)	1	7	9	÷ 37 =			9	
(68)	4	13	2	÷ 43 =	2	2		
(69)	24	9	1½	÷ 39 =	12	6½		
(70)	3	12	5½	÷ 47 =	1	6½		
(71)	1	16	9	÷ 53 =		9		
(72)	19	3	6	÷ 59 =	6	6		
(73)	5	18	4	÷ 71 =	1	8		
(74)	19	7	4	÷ 83 =	4	8		
(75)	29	13	4	÷ 89 =	6	8		
(76)	32	6	8	÷ 97 =	6	8		
(77)	43	5	8	÷ 106 =	8	2		
(78)	55	8	2	÷ 109 =	10	2		
(79)	34	1	7½	÷ 123 =	5	6½		
(80)	167	19	2	÷ 145 =	1	3	2	
(81)	0	18	11¼	÷ 25¼ =		9		
(82)	3	12	5¼	÷ 30½ =	2	4½		
(83)	54	10	4½	÷ 35¾ =	1	10	6	
(84)	1301	1	3	÷ 40½ =	32	2	6	
(85)	167	1	0	÷ 64¼ =	2	12	0	

DUODECIMALS.

*Answers.**

$$\begin{array}{r}
 \text{(1)} \quad \begin{array}{cc} F. & I. \\ 6 & 6 \\ 3 & 2 \end{array} \\
 \hline
 \begin{array}{cc} 19 & 6 \\ 1 & 1 \end{array} \\
 \hline
 20 \cdot 7 \text{ Ans.}
 \end{array}$$

$$\begin{array}{r}
 \text{(2)} \quad \begin{array}{cc} F. & I. \\ 8 & 4 \\ 5 & 3 \end{array} \\
 \hline
 \begin{array}{cc} 41 & 8 \\ 2 & 1 \end{array} \\
 \hline
 43 \cdot 9 \text{ Ans.}
 \end{array}$$

$$\begin{array}{r}
 \text{(3)} \quad \begin{array}{cc} 12 & 6 \\ 8 & 5 \end{array} \\
 \hline
 \begin{array}{ccc} 100 & 0 & \\ 5 & 2 & 6 \end{array} \\
 \hline
 105 \cdot 2 \cdot 6
 \end{array}$$

$$\begin{array}{r}
 \text{(4)} \quad \begin{array}{cc} 26 & 4 \\ 12 & 7 \end{array} \\
 \hline
 \begin{array}{ccc} 316 & 0 & \\ 15 & 4 & 4 \end{array} \\
 \hline
 331 \cdot 4 \cdot 4
 \end{array}$$

$$\begin{array}{r}
 \text{(5)} \quad \begin{array}{cc} 76 & 6 \\ 48 & 3 \end{array} \\
 \hline
 \begin{array}{ccc} 3672 & 0 & \\ 19 & 1 & 6 \end{array} \\
 \hline
 3691 \cdot 1 \cdot 6
 \end{array}$$

$$\begin{array}{r}
 \text{(6)} \quad \begin{array}{cc} 45 & 6 \\ 38 & 7 \end{array} \\
 \hline
 \begin{array}{ccc} 1729 & 0 & \\ 26 & 6 & 6 \end{array} \\
 \hline
 1755 \cdot 6 \cdot 6
 \end{array}$$

$$\begin{array}{r}
 \text{(7)} \quad \begin{array}{cc} 84 & 2 \\ 79 & 2 \end{array} \\
 \hline
 \begin{array}{ccc} 6649 & 2 & \\ 14 & 0 & 4 \end{array} \\
 \hline
 6663 \cdot 2 \cdot 4
 \end{array}$$

$$\begin{array}{r}
 \text{(8)} \quad \begin{array}{cc} 126 & 6 \\ 121 & 3 \end{array} \\
 \hline
 \begin{array}{ccc} 15306 & 6 & \\ 31 & 7 & 6 \end{array} \\
 \hline
 15338 \cdot 1 \cdot 6
 \end{array}$$

* These examples are all proved by Practice.

$$\begin{array}{r}
 \begin{array}{cc} F. & I. \\ (9) & 764 \quad 5 \\ & 192 \quad 4 \end{array} \\
 \hline
 \begin{array}{cc} 146768 & 0 \\ & 254 \quad 9 \quad 8 \end{array} \\
 \hline
 \begin{array}{cc} 147022 & 9 \quad 8 \end{array} \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 \begin{array}{cc} F. & I. \\ (10) & 7681 \quad 8 \\ & 1926 \quad 10 \end{array} \\
 \hline
 \begin{array}{cc} 14794890 & 0 \\ & 6401 \quad 4 \quad 8 \end{array} \\
 \hline
 \begin{array}{cc} 14801291 & 4 \quad 8 \end{array} \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 \begin{array}{ccc} F. & I. & P. \\ (11) & 7 \quad 3 \quad 3 \\ & 1 \quad 7 \quad 6 \end{array} \\
 \hline
 \begin{array}{cccc} 7 & 3 & 3 & \\ 4 & 2 & 10 & 9 \\ & 3 & 7 & 7 \quad 6 \end{array} \\
 \hline
 \begin{array}{cccc} 11 & 9 & 9 & 4 \quad 6 \end{array} \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 \begin{array}{ccc} F. & I. & P. \\ (12) & 8 \quad 6 \quad 6 \\ & 7 \quad 3 \quad 4 \end{array} \\
 \hline
 \begin{array}{cccc} 59 & 9 & 6 & \\ 2 & 1 & 7 & 6 \\ & 2 & 10 & 2 \end{array} \\
 \hline
 \begin{array}{cccc} 62 & 1 & 11 & 8 \end{array} \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 \begin{array}{ccc} 4 & 10 & 6 \\ (13) & 2 & 4 \quad 8 \end{array} \\
 \hline
 \begin{array}{ccc} 9 & 0 & 0 \\ 1 & 7 & 6 \\ & 3 & 3 \end{array} \\
 \hline
 \begin{array}{ccc} 11 & 7 & 9 \end{array} \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 \begin{array}{ccc} 7 & 8 & 6 \\ (14) & 7 & 2 \quad 8 \end{array} \\
 \hline
 \begin{array}{cccc} 53 & 11 & 6 & \\ 1 & 3 & 5 & 0 \\ & 5 & 1 & 8 \end{array} \\
 \hline
 \begin{array}{cccc} 55 & 8 & 0 & 8 \end{array} \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 \begin{array}{ccc} 3 & 6 & 3 \\ (15) & 2 & 4 \quad 6 \end{array} \\
 \hline
 \begin{array}{cccc} 7 & 0 & 6 & \\ 1 & 2 & 1 & 0 \\ & 1 & 9 & 1 \quad 6 \end{array} \\
 \hline
 \begin{array}{cccc} 8 & 4 & 4 & 1 \quad 6 \end{array} \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 \begin{array}{ccc} 12 & 2 & 10 \\ (16) & 9 & 6 \quad 4 \end{array} \\
 \hline
 \begin{array}{cccc} 110 & 1 & 6 & \\ 6 & 1 & 5 & 0 \\ & 4 & 0 & 11 \quad 4 \end{array} \\
 \hline
 \begin{array}{cccc} 116 & 6 & 11 & 11 \quad 4 \end{array} \\
 \hline
 \end{array}$$

DUODECIMALS.

25

$$\begin{array}{r}
 \begin{array}{rcc}
 (17) & F. & I. & P. \\
 & 84 & 7 & 6 \\
 & 76 & 3 & 3 \\
 \hline
 & 6431 & 6 & 0 \\
 & 21 & 1 & 10 \quad 6 \\
 & 1 & 9 & 1 \quad 10 \quad 6 \\
 \hline
 & 6454 & 5 & 0 \quad 4 \quad 6 \\
 \hline
 \end{array}
 \end{array}$$

$$\begin{array}{r}
 \begin{array}{rcc}
 (18) & F. & I. & P. \\
 & 87 & 3 & 5 \\
 & 18 & 1 & 6 \\
 \hline
 & 1571 & 1 & 6 \\
 & 7 & 3 & 3 \quad 5 \\
 & 3 & 7 & 7 \quad 8 \quad 6 \\
 \hline
 & 1580 & 0 & 5 \quad 1 \quad 6 \\
 \hline
 \end{array}
 \end{array}$$

$$\begin{array}{r}
 \begin{array}{rcc}
 (19) & 371 & 2 & 3 \\
 & 181 & 1 & 3 \\
 \hline
 & 67184 & 11 & 3 \\
 & 30 & 11 & 2 \quad 3 \\
 & 7 & 8 & 9 \quad 6 \quad 9 \\
 \hline
 & 67223 & 7 & 2 \quad 9 \quad 9 \\
 \hline
 \end{array}
 \end{array}$$

$$\begin{array}{r}
 \begin{array}{rcc}
 (20) & 487 & 10 & 10 \\
 & 186 & 5 & 6 \\
 \hline
 & 90749 & 11 & 0 \\
 & 203 & 3 & 6 \quad 2 \\
 & 20 & 3 & 11 \quad 5 \quad 0 \\
 \hline
 & 90973 & 6 & 5 \quad 7 \quad 0 \\
 \hline
 \end{array}
 \end{array}$$

$$\begin{array}{r}
 \begin{array}{rcc}
 (21) & F. & I. \\
 & 18 & 6 \\
 & 1 & 2 \\
 \hline
 & 18 & 6 \\
 & 3 & 1 \quad 0 \\
 \hline
 & 21 & 7 \quad 0 \\
 \hline
 \end{array}
 \end{array}$$

$$\begin{array}{r}
 \begin{array}{rcc}
 (22) & F. & I. \\
 & 45 & 6 \\
 & 9 & 4 \\
 \hline
 & 409 & 6 \\
 & 15 & 2 \quad 0 \\
 \hline
 & 424 & 8 \quad 0 \\
 \hline
 \end{array}
 \end{array}$$

$$\begin{array}{r}
 \begin{array}{rcc}
 (23) & 64 & 6 \\
 & 47 & 8 \\
 \hline
 & 3031 & 6 \\
 & 43 & 0 \quad 0 \\
 \hline
 & 9)3074 & 6 \quad 0 \\
 \hline
 \text{Yards} & 341 & 5 \quad 6 \\
 \hline
 \end{array}
 \end{array}$$

$$\begin{array}{r}
 \begin{array}{rcc}
 (24) & 864 & 3 \\
 & 62 & 6 \\
 \hline
 & 53583 & 6 \\
 & 432 & 1 \quad 6 \\
 \hline
 & 9)54015 & 7 \quad 6 \\
 \hline
 \text{Yards} & 6001 & 6 \quad 7 \quad 6 \\
 \hline
 \end{array}
 \end{array}$$

$$\begin{array}{r} \text{(25)} \quad \begin{array}{cc} F. & I. \\ 60 & 9 \\ 22 & 3 \end{array} \end{array}$$

$$\begin{array}{r} 1336 \quad 6 \\ 15 \quad 2 \quad 3 \end{array}$$

$$\begin{array}{r} 9)1351 \quad 8 \quad 3 \end{array}$$

$$\text{Yards } 150 \quad 1 \quad 8 \quad 3$$

$$\begin{array}{r} \text{(27)} \quad \begin{array}{ccc} F. & I. & P. \\ 3 & 8 & 9 \\ 1 & 4 & 6 \end{array} \\ \hline \begin{array}{ccc} 3 & 8 & 9 \\ 1 & 2 & 11 \quad 0 \\ & 1 & 10 \quad 4 \quad 6 \end{array} \\ \hline \begin{array}{ccc} 5 & 1 & 6 \quad 4 \quad 6 \end{array} \end{array}$$

$$\begin{array}{r} \text{(26)} \quad \begin{array}{cc} F. & I. \\ 40 & 6 \\ 9 & 3 \end{array} \end{array}$$

$$\begin{array}{r} 364 \quad 6 \\ 10 \quad 1 \quad 6 \end{array}$$

$$\begin{array}{r} 9)374 \quad 7 \quad 6 \end{array}$$

$$\text{Yards } 41 \quad 5 \quad 7 \quad 6$$

$$\begin{array}{r} \text{(28)} \quad \begin{array}{ccc} F. & I. & P. \\ 3 & 7 & 9 \\ 1 & 5 & 1 \end{array} \\ \hline \begin{array}{ccc} 3 & 7 & 9 \\ 1 & 6 & 2 \quad 9 \\ & 3 & 7 \quad 9 \end{array} \\ \hline \begin{array}{ccc} 5 & 2 & 3 \quad 4 \quad 9 \end{array} \\ \hline 3 \times 5 = 15 \\ \begin{array}{ccc} 15 & 6 & 10 \quad 2 \quad 3 \\ & & 5 \end{array} \end{array}$$

$$F. 77 \quad 10 \quad 2 \quad 11 \quad 3$$

$$\begin{array}{r} \text{(29)} \quad \begin{array}{cc} F. & I. \\ 1 & 6 \\ 1 & 3 \end{array} \\ \hline \begin{array}{cc} 1 & 6 \\ & 4 \quad 6 \end{array} \\ \hline \begin{array}{ccc} 1 & 10 & 6 \\ 16 & 3 & \text{long} \end{array} \\ \hline \begin{array}{ccc} 30 & 0 & 0 \\ & 5 & 7 \quad 6 \end{array} \\ \hline F. 30 \quad 5 \quad 7 \quad 6 \end{array}$$

$$\begin{array}{r} \text{(30)} \quad \begin{array}{ccc} F. & I. & P. \\ 1 & 5 & 6 \\ 1 & 2 & 10 \end{array} \\ \hline \begin{array}{ccc} 1 & 5 & 6 \\ & 2 & 11 \quad 0 \\ & 1 & 2 \quad 7 \quad 0 \end{array} \\ \hline \begin{array}{ccc} 1 & 9 & 7 \quad 7 \quad 0 \\ 12 & 3 & 7 \quad \text{long} \end{array} \\ \hline \begin{array}{ccc} 21 & 7 & 7 \quad 0 \quad 0 \\ & 5 & 4 \quad 10 \quad 9 \quad 0 \\ & 1 & 0 \quad 7 \quad 5 \quad 1 \quad 0 \end{array} \\ \hline F. 22 \quad 2 \quad 0 \quad 6 \quad 2 \quad 1 \quad 0 \end{array}$$

REDUCTION.

27

REDUCTION.

Answers.

$$\begin{array}{r}
 (1) \quad \begin{array}{r} \text{s.} \\ 20 \\ 12 \\ \hline 240 \text{ pence.} \\ 4 \\ \hline 960 \text{ farthings.} \end{array}
 \end{array}$$

$$\begin{array}{r}
 (2) \quad \begin{array}{r} \text{grs.} \\ 4)960 \\ \hline 12)240 \\ \hline 20\text{s.} \end{array}
 \end{array}$$

$$\begin{array}{r}
 (3) \quad \begin{array}{r} \text{£} \\ 36 \\ 20 \\ \hline 720 \\ 12 \\ \hline 8640 \\ 4 \\ \hline 34560 \end{array}
 \end{array}$$

$$\begin{array}{r}
 (4) \quad \begin{array}{r} \text{grs.} \\ 4)34560 \\ \hline 12)8640 \\ \hline 2)0)72)0 \\ \hline \text{£ } 36 \end{array}
 \end{array}$$

- (5) $346\text{l. } 6\text{s. } 8\frac{1}{2}\text{d.} = 332481 \text{ farthings.}$
 (6) $332481 \text{ farthings} = 346\text{l. } 6\text{s. } 8\frac{1}{2}\text{d.}$
 (7) $86 \text{ guineas} \times 1008 = 86688 \text{ farthings.}$
 (8) $86688 \div 1008 = 86 \text{ guineas.}$
 (9) $384\text{l.} \times 60 = 23040 \text{ fourpences.}$
 (10) $23040 \text{ groats} \div 60 = 384 \text{ pounds.}$
 (11) $682 \text{ moidores} = 883872 \text{ farthings.}$
 (12) $883872 \text{ farthings} = 682 \text{ moidores.}$
 (13) $1000\text{l.} = 4000 \text{ crowns, } 8000 \text{ half-crowns, } 24000 \text{ pence.}$
 (14) $24000 \text{ pence} = 4000 \text{ crowns, } 8000 \text{ half crowns, } 1000 \text{ pounds.}$

- (32) First, $13\frac{1}{2}d. + 12d. + 9d. + 6d. + 4d. + 2d. = 46\frac{1}{2}d. =$
93 halfpence; then $300 \times 93 = 27900$ halfpence =
58*l.* 2*s.* 6*d.*
- (33) First, $4*s.* 3*d.* = 51$ pence; then $1120 \times 51 = 57120$
pence = 238*l.*
- (34) First, $238*l.* = 57120$ pence, and $4*s.* 3*d.* = 51$ pence;
then $57120 \div 51 = 1120$ dollars.
- (35) Here, $560 \times 17 + 20 = 476*l.*$
- (36) Here, $476 \times 20 + 17 = 560$ pistoles.
- (37) First, $5*s.* 3*d.* = 63$ pence, or one quarter guinea;
then $800 \times 63 = 50400$ pence = 210*l.*
- (38) First, $5*s.* 3*d.* = 63$ pence, and $210*l.* = 50400$ pence;
then $50400 \div 63 = 800$ quarter guineas.
- (39) First, $6*s.* 8*d.* = 80$ pence; then $896 \times 80 = 71680$
pence = 298*l.* 13*s.* 4*d.*
- (40) First, $298*l.* 13*s.* 4*d.* = 71680$ pence, and $6*s.* 8*d.* = 80$
pence; then $71680 \div 80 = 896$ nobles.
- (41) Here, $225 \times 21 + 27 = 175$ moidores.
- (42) Here, $175 \times 27 + 21 = 225$ guineas.
- (43) Here, $170 \times 17 + 5 = 578$ crowns.
- (44) Here, $578 \times 5 + 17 = 170$ pistoles.
- (45) First, $5*s.* 6\frac{1}{2}d. = 133$ halfpence, and $4*s.* 7*d.* = 110$
halfpence; then $14630 \times 110 + 133 = 12100$ duca-
toons.
- (46) First, $4*s.* 7*d.* = 110$ halfpence, and $5*s.* 6\frac{1}{2}d. = 133$
halfpence; then $12100 \times 133 + 110 = 14630$ cobs,
- (47) First, $6*s.* 8\frac{1}{2}d. = 161$ halfpence, and $7*s.* 6*d.* = 180$
halfpence; then $644 \times 180 + 161 = 720$ milreas.
- (48) First, $7*s.* 6*d.* = 180$ halfpence, and $6*s.* 8\frac{1}{2}d. = 161$
halfpence; then $720 \times 161 + 180 = 644$ Romish
crowns.
- (49) First, $1*l.* 1*s.* 8*d.* = 260$ pence, and $1*l.* = 240$ pence;
then $1500 \times 260 + 240 = 1625*l.*$ Irish.
- (50) Here, $1625 \times 240 + 260 = 1500$ English.
- (51) $23*lb.* \times 480 = 132480$ grains.

- (52) $132480 \text{ grs.} + 480 = 23 \text{ pounds.}$
- (53) $18 \text{ lb. } 6 \text{ oz. } 8 \text{ dwt. } 4 \text{ gr.} = 106756 \text{ grains}$
- (54) $106756 \text{ gr.} = 18 \text{ lb. } 6 \text{ oz. } 8 \text{ dwt. } 4 \text{ gr.}$
- (55) First, $3 \text{ lb. } 4 \text{ oz. } 2 \text{ dwt. } 9 \text{ gr.} = 19257 \text{ grains; then}$
 $19257 \times 8 = 154056 \text{ grains.}$
- (56) First, $3 \text{ lb. } 4 \text{ oz. } 2 \text{ dwt. } 9 \text{ gr.} = 19257 \text{ grains; then}$
 $154056 \div 19257 = 8 \text{ ingots.}$
- (57) First, $55 \text{ oz. } 9 \text{ dwt. } 14 \text{ gr.} = 26630 \text{ grains, and}$
 $41 \text{ lb. } 7 \text{ oz. } 6 \text{ dwt. } 6 \text{ gr.} = 239670 \text{ grains; then}$
 $239670 \div 26630 = 9 \text{ tankards.}$
- (58) Here, $55 \text{ oz. } 9 \text{ dwt. } 14 \text{ gr.} \times 9 = 41 \text{ lb. } 7 \text{ oz. } 6 \text{ dwt.}$
 6 grains.
- (59) $24 \times 12 \times 8 \times 3 \times 20 = 138240 \text{ grains.}$
- (60) $138240 \div 5760 = 24 \text{ pounds.}$
- (61) $421 \text{ lb. } 6 \text{ oz. } 3 \text{ dr. } 2 \text{ sc. } 9 \text{ gr.} = 2428069 \text{ grains.}$
- (62) $2428069 \text{ gr.} = 421 \text{ lb. } 6 \text{ oz. } 3 \text{ dr. } 2 \text{ sc. } 9 \text{ grains.}$
- (63) First, $12 \text{ lb. } 6 \text{ oz.} = 3600 \text{ scruples; then } 3600 \div 4 =$
 $900 \text{ boluses; and } 900 \div 45 = 20 \text{ boluses to each}$
 patient.
- (64) $45 \times 20 \times 4 = 3600 \text{ sc.} = 12 \text{ lb. } 6 \text{ oz.}$
- (65) $16 \times 20 \times 112 \times 16 \times 16 = 9175040 \text{ drachms.}$
- (66) $9175040 \div 16 \div 16 \div 112 \div 20 = 16 \text{ tons.}$
- (67) $146 \text{ ton. } 12 \text{ cwt. } 2 \text{ qr. } 8 \text{ lb. } 4 \text{ oz. } 6 \text{ dr.} = 84082758$
 drachms.
- (68) $84082758 \text{ drs.} = 146 \text{ ton. } 12 \text{ cwt. } 2 \text{ qr. } 8 \text{ lb. } 4 \text{ oz. } 6$
 drachms.
- (69) First, $7 \text{ cwt. } 2 \text{ qr. } 21 \text{ lb.} = 861 \text{ pounds; then } 861 \times 7$
 $= 6027 \text{ pounds.}$
- (70) First, $7 \text{ cwt. } 2 \text{ qr. } 21 \text{ lb.} = 861 \text{ pounds; then } 6027 \div$
 $861 = 7 \text{ hogsheads.}$
- (71) First, $41 \text{ cwt. } 1 \text{ qr. } 18 \text{ lb. } 2 \text{ oz.} = 74210 \text{ ounces, and}$
 $12 \text{ lb. } 13 \text{ oz.} = 205 \text{ ounces; then } 74210 \div 205 = 362$
 parcels.
- (72) First, $12 \text{ lb. } 13 \text{ oz.} = 205 \text{ ounces; then } 362 \times 205 =$
 $74210 \text{ ounces} = 41 \text{ cwt. } 1 \text{ qr. } 18 \text{ lb. } 2 \text{ ounces.}$

- (73) First, $4+6+10+12=32$ pounds, and 4 cwt. 2 qr. 8 lb. $\times 4=512 \times 4=2048$ pounds; then $2048+32=64$ parcels.
- (74) First, $4+6+10+12 \times 64=32 \times 64=2048$ pounds; then $2048+112=4$ cwt. 2 qr. 8 lb. weight of one hogshead.
- (75) $342 \times 16=5472$ nails.
- (76) $5472 \div 16=342$ yards.
- (77) 62 yd. 2 qr. 1 na.=1001 nails.
- (78) $1001 \div 4 \div 4=62$ yd. 2 qr. 1 nail.
- (79) 40 E. ells. 3 qr. 2 na.=814 nails.
- (80) $814 \div 4 \div 5=40$ E. ells. 3 qr. 2 nails.
- (81) 84 Fl. ells. 2 qr. 3 na.=1019 nails.
- (82) $1019 \text{ na.} \div 4 \div 3=84$ Fl. ells. 2 qr. 8 nails.
- (83) $36 \times 52 \times 16=29952$ nails.
- (84) First $52 \times 16=832$ nails; then $29952 \div 832=36$ pieces.
- (85) $90 \times 3\frac{1}{2}=292\frac{1}{2}$ yards.
- (86) $292\frac{1}{2} \div 90=3\frac{1}{2}$ yards for each boy.
- (87) 1 lea. $\times 3 \times 8 \times 40=3$ miles, 24 furlongs, 960 poles.
- (88) $960 \div 40 \div 8 \div 3=1$ league.
- (89) 48 miles=384 furlongs, 15360 poles, 84480 yards, 253440 feet, 3041280 inches, 9123840 barley corns.
- (90) 9123840 b. c.=48 miles.
- (91) First $25 \times 1760 \times 6=264000$ half feet, and $16\frac{1}{2} \times 2=33$ half feet; then $264000 \div 33=8000$ turns.
- (92) $8000 \times 16\frac{1}{2}=132000$ feet=25 miles.
- (93) 25020×1056 (paces in one mile)=26421120 paces, and $26421120 \times 5 \times 12 \times 3=132105600$ feet, 1585267200 inches, 4755801600 barley corns.
- (94) $4755801600 \div 190080=25020$ miles.
- (95) $284 \times 4 \times 40=77440$ poles.
- (96) $77440 \div 180=484$ acres.
- (97) 4321 acres, 3 roods, 34 poles=691514 poles.

- (98) $691514 \div 40 \div 4 = 4321$ acres, 3 roods, 34 poles.
- (99) $4140 \times 160 = 662400$ perches; then $662400 \div 360 = 1840$ shares.
- (100) $1840 \times 360 = 662400$ perches; then $662400 \div 160 = 4140$ acres.
- (101) $46 \times 63 \times 8 = 23184$ pints.
- (102) $23184 \div 504 = 46$ hogsheads.
- (103) 46 tons, 3 hhds. 45 galls. 3 qts. 1 pt. = 94615 pints.
- (104) $94615 \div 8 \div 63 \div 4 = 46$ tons. 3 hhd. 45 gall. 3 qr. 1 pint.
- (105) First, $15 \text{ hhds.} \times 63 \times 8 = 7560$ pts., and 12 qts. 12 pts. = 36 pts.; then $7560 \div 36 = 210$ dozen of each.
- (106) $210 \text{ doz.} \times 36 \text{ pts.} \div 504 = 7560 \div 504 = 15$ hhds.
- (107) $21 \times 48 \times 8 = 8064$ pints.
- (108) $8064 \div 8 \div 48 = 21$ hogsheads.
- (109) $30 \times 54 \times 8 = 12960$ pints.
- (110) $12960 \div 8 \div 54 = 30$ hogsheads.
- (111) $363 \times 1\frac{1}{2} \times 54 \times 8 = 242$ hhds. 13068 gall. 104544 pints.
- (112) $104544 \div 8 \div 54 \div 1\frac{1}{2} = 363$ barrels.
- (113) First 6 bts. 1 hhd. 40 gall. 2 qts. = 2970 quarts; and $54 \div 36 \div 9 = 99$ gall. = 396 quarts; then $2970 \div 396 = 7$ of each sort, and 198 quarts over.
- (114) First $54 \div 36 \div 9 \times 4 = 396$ qts; 7 hhd. 7 bar. 7 fir. 198 qts. = 2970 quarts; then $2970 \div 396 = 1166120$ qts. = 6 butts. 1 hhd. 40 gall. 2 quarts.
- (115) $304 \times 8 \times 8 = 19456$ gallons.
- (116) $19456 \div 64 = 304$ quarters.
- (117) $4 \times 10 \times 8 \times 8 \times 8 = 20480$ pints.
- (118) $20480 \div 8 \div 8 \div 8 \div 10 = 4$ lasts.
- (119) 2 lasts. 1 w. 3 q. 2 b. 3 p. 1 g. = 1815 gallons.
- (120) 1815 galls. = 2 l. 1 w. 3 q. 2 b. 3 p. 1 g.

- (121) $124 \times 36 \times 4 = 17856$ pecks.
 (122) $17856 \div 4 \div 36 = 124$ chaldrons.
 (123) 421 ch. 12 bus. $= 15168$ bus.; and $15168 \div 3 = 5056$ sacks.
 (124) $5056 \times 3 \div 36 = 421$ ch. 12 bus.
 (125) A solar year $= 365$ days 5 ho. 48 min. 55 sec. $= 31556935$ sec.
 (126) 31556935 sec. $= 365$ days 5 hrs. 48 min. 55 sec.
 (127) First $4004 + 1785 = 5792$ years since the creation;
 then $31556935 \times 5792 = 182777767520$ seconds.
 (128) $182777767520 \div 31556935 = 5792$ solar years.
 (129) $12 \times 360 \times 60 \times 60 = 15552000$ seconds.
 (130) $15552000 \div 60 \div 60 \div 360 = 12$ revolutions.
 (131) 41 rev. 6 signs 4 deg. 30 min. 45 sec. $= 53800245$ seconds.
 (132) 53800245 sec. $= 41$ rev. 6 signs 4 deg. 30 min. 45 sec.
 (133) $1 \times 9 \times 144 = 1296$ square inches.
 (134) $1296 \div 144 \div 9 = 1$ square yard.
 (135) 864 ft. 3 in. $\times 62$ ft. 6 in. $\div 9 = 6001$ yds. 6 ft. 7 in. 6 parts.
 (136) 1 sq. mile $= 640$ acres, 2560 roods, 102400 poles, 3097600 yards, 27878400 feet, 4014489600 inches.
 (137) 4014489600 inches $= 1$ square mile.
 (138) 1 solid yard $= 27$ feet, 46656 solid inches.
 (139) 46656 solid inches $= 1$ solid yard.
 (140) 16 ft. 3 in. $\times 18$ in. $\times 15$ in. $= 30$ ft. 5 in. 7 pts. 5 sec.

THE RULE OF THREE DIRECT.

Ex. (1) is worked.

$$(1) \quad 2l. \ 14s. \ : \ : \ 9 \ yds. \ : \ : \ 18s. \ : \ : \ 3 \ yds.$$

$$(2) \quad 4 \ yds. \ : \ : \ 2l. \ : \ : \ 14 \ yds. \ : \ : \ 7l.$$

- (4) 7*l.* : 14 yds. :: 2*l.* : 4 yds.
- (5) 9 yds. : 3*l.* :: 36 yds. : 12*l.*
- (6) 12*l.* : 36 yds. :: 3*l.* : 9 yds.
- (7) 3 yds. : 2*l.* 9*s.* :: 24 yds. : 19*l.* 12*s.*
- (8) 19*l.* 12*s.* : 24 yds. :: 2*l.* 9*s.* : 3 yds.
- (9) 4 yds. : 1*l.* 9*s.* :: 48 yds. : 17*l.* 8*s.*
- (10) 17*l.* 8*s.* : 48 yds. :: 1*l.* 9*s.* : 4 yds.
- (11) 7 yds. : 3*l.* 6*s.* 6*d.* :: 36 yds. : 17*l.* 2*s.*
- (12) 17*l.* 2*s.* : 36 yds. :: 3*l.* 6*s.* 6*d.* : 7 yds.
- (13) 8 yds. : 18*s.* 8*d.* :: 54 yds. : 6*l.* 6*s.*
- (14) 6*l.* 6*s.* : 54 yds. :: 18*s.* 8*d.* : 8 yds.
- (15) 9 ft. : 15*s.* 9*d.* :: 72 ft. : 6*l.* 6*s.*
- (16) 6*l.* 6*s.* : 72 ft. :: 15*s.* 9*d.* : 9 ft.
- (17) 10 lb. : 1*l.* 2*s.* 1*d.* :: 81 lb. : 8*l.* 18*s.* 10½*d.*
- (18) 8*l.* 18*s.* 10½*d.* : 81 lb. :: 1*l.* 2*s.* 1*d.* : 10 lb.
- (19) 12 qrs. : 14*l.* 11*s.* :: 90 qrs. : 109*l.* 2*s.* 6*d.*
- (20) 109*l.* 2*s.* 6*d.* : 90 qrs. :: 14*l.* 11*s.* : 12 qrs.
- (21) 14 lb. : 12*l.* 5*s.* : 99 lb. : 86*l.* 12*s.* 6*d.*
- (22) 86*l.* 12*s.* 6*d.* : 99 lb. :: 12*l.* 5*s.* : 14 lb.
- (23) 15 lb. : 5*l.* 18*s.* 1½*d.* :: 108 lb. : 42*l.* 10*s.* 6*d.*
- (24) 42*l.* 10*s.* 6*d.* : 108 lb. :: 5*l.* 18*s.* 1½*d.* : 15 lb.
- (25) 18 yds. : 17*l.* 19*s.* 7½*d.* :: 48 yds. : 47*l.* 19*s.*
- (26) 47*l.* 19*s.* : 48 yds. :: 17*l.* 19*s.* 7½*d.* : 18 yds.
- (27) 21 ells : 5*l.* 18*s.* 1½*d.* :: 72 ells : 20*l.* 5*s.*
- (28) 20*l.* 5*s.* : 72 ells :: 5*l.* 18*s.* 1½*d.* : 21 ells.
- (29) 27 pair : 8*l.* 0*s.* 10½*d.* :: 81 pair : 24*l.* 2*s.* 7½*d.*
- (30) 24*l.* 2*s.* 7½*d.* : 81 pair : 8*l.* 0*s.* 10½*d.* : 27 pair.
- (31) 45 doz. : 73*l.* 2*s.* 6*d.* :: 120 doz. : 195*l.*
- (32) 195*l.* : 120 doz. :: 73*l.* 2*s.* 6*d.* : 45 doz.
- (33) 56 qrs. : 63*l.* :: 144 qrs. : 162*l.*

- (34) 162l. : 144 qrs. :: 63l. : 56 qrs.
- (35) 72 galls. : 6l. :: 25 hhd.; or 8100 galls.
112l. 10s.
- (36) 112l. 10s. : 25 hhd. :: 6l. : 72 galls.
- (37) 77 gross : 12l. 5s. 5½d. :: 144 gross : 22l. 19s.
- (38) 22l. 19s. : 144 gross :: 12l. 5s. 5½d. : 77 gross.
- (39) 6l. : 81 lb. :: 15l. 10s. : 209½ lb.
- (40) 209½ lb. : 15l. 10s. :: 81 lb. : 6l.
- (41) 70 yds. : 78l. 15s. :: 38l. 5s. : 34 yds.
- (42) 34 yds. : 38l. 5s. :: 70 yds. : 78l. 15s.
- (43) 7½ yds. : 17s. 6d. :: 515 yds. : 60l. 1s. 8d.
- (44) 60l. 1s. 8d. : 515 yds. :: 17s. 6d. : 7½ yds.
- (45) 3 oz. 10 dwts. : 1l. 1s. 10½d. :: 655 oz. 4 dwt. 16 grs. : 204l. 15s. 2½d.
- (46) 204l. 15s. 2½d. : 655 oz. 4 dwt. 16 grs. :: 1l. 1s. 10½d. : 3 oz. 10 dwt.
- (47) 2 hhd. 19½ galls. : 93l. 1s. 2½d. :: 12 pipes 1 hhd. 36 galls. : 1030l. 7s. 4½d.
- (48) 1030l. 7s. 4½d. : 12 pipes 1 hhd. 36 gall. :: 93l. 1s. 2½d. : 2 hhd. 19½ galls.
- (49) First 5 cwt. 2 qr. 18 lb. $\times 10 = 56$ cwt. 2 qr. 12 lb. whole weight; then 16½ lb. : 8s. 11½d. :: 56 cwt. 2 qr. 12 lb. : 171l. 14s. 2d.
- (50) 171l. 14s. 2d. : 56 cwt. 2 qr. 12 lb. :: 8s. 11½d. : 16½ lb.
- (51) First, 8 cwt. 1 qr. 12 lb. $\times 9 = 75$ cwt. 24 lb.; then 1 cwt. 3 qr. 19 lb. 4 oz. : 15l. 10s. :: 75 cwt. 24 lb. : 624l.
- (52) 624l. : 75 cwt. 24 lb. :: 15l. 10s. : 1 cwt. 3 qr. 19 lb. 4 oz.
- (53) First, 8 cwt. 3 qr. 6 lb. 4 oz. $\times 5 = 44$ cwt. 3 lb. 4 oz.; then, 4 cwt. 2 qr. 6 lb. 8 oz. : 24l. 16s. 8½d. :: 44 cwt. 3 lb. 4 oz. : 239l. 17s. 9½d.

36 THE RULE OF THREE DIRECT.

- (54) $239\text{ l. } 17\text{ s. } 9\frac{1}{4}\frac{5}{8}\frac{1}{8}\text{ d.} : 44\text{ cwt. } 3\text{ lb. } 4\text{ oz.} ::$
 $24\text{ l. } 16\text{ s. } 8\frac{1}{2}\text{ d.} : 8168\text{ oz.}$
- (55) $252\text{ galls.} : 50\text{ l. } 8\text{ s. } 6\frac{1}{2}\text{ d.} :: 12\text{ tons } 3\text{ hhds.}$
 $46\text{ galls.} : 652\text{ l. } 3\text{ s. } 3\frac{1}{2}\frac{4}{5}\frac{1}{2}\text{ d.}$
- (56) $652\text{ l. } 3\text{ s. } 3\frac{1}{2}\frac{4}{5}\frac{1}{2}\text{ d.} : 12\text{ tons } 3\text{ hhd. } 46\text{ gall.} ::$
 $50\text{ l. } 8\text{ s. } 6\frac{1}{2}\text{ d.} : 252\text{ galls.}$
- (57) $69\text{ l. } 18\text{ s. } 7\text{ d.} : 1\text{ cwt. } 1\text{ qr. } 7\text{ lb. } 4\text{ oz.} :: 560\text{ l.}$
 $10\text{ s. } 4\frac{1}{4}\text{ d.} : 10\text{ cwt. } 2\text{ qr. } 4\text{ lb. } 4\frac{3}{4}\frac{8}{11}\frac{1}{2}\text{ oz.}$
- (58) $10\text{ cwt. } 2\text{ qr. } 4\text{ lb. } 4\text{ oz. } \frac{3}{4}\frac{8}{11}\frac{1}{2} : 560\text{ l. } 10\text{ s. } 4\frac{1}{4}\text{ d.}$
 $:: 1\text{ cwt. } 1\text{ qr. } 7\text{ lb. } 4\text{ oz.} : 69\text{ l. } 18\text{ s. } 7\text{ d.}$
- (59) First, $24 \times 24 \times 40 \times 120 = 2764800\text{ yds. in all; then}$
 $24\text{ yds.} : 8\text{ l. } 17\text{ s. } 6\frac{1}{2}\text{ d.} :: 2764800\text{ yds.} : 1022760\text{ l.}$
- (60) $1022760\text{ l.} : 2764800\text{ yds.} :: 8\text{ l. } 17\text{ s. } 6\frac{1}{2}\text{ d.} : 24\text{ yds.}$
- (61) $43\text{ lb. } 6\text{ oz. } 3\text{ drs.} : 2\text{ l. } 5\text{ s. } 1\frac{1}{2}\text{ d.} :: 4\text{ tons } 6\text{ cwt.}$
 $2\text{ qr. } 4\text{ lb. } 6\text{ oz.} : 503\text{ l. } 16\text{ s. } 0\frac{1}{2}\frac{1}{11}\frac{10}{7}\text{ d.}$
- (62) $503\text{ l. } 16\text{ s. } 0\frac{1}{2}\frac{1}{11}\frac{10}{7}\text{ d.} : 4\text{ tons } 6\text{ cwt. } 2\text{ qr. } 4\text{ lb.}$
 $6\text{ oz.} : 2\text{ l. } 5\text{ s. } 1\frac{1}{2}\text{ d.} : 11107\text{ drs.}$
- (63) First, $240\text{ l. } 2\text{ s.} + 42\text{ l. (gain)} = 282\text{ l. } 2\text{ s. the cloves}$
 $\text{must be sold for; then } 16\text{ cwt. } 2\text{ qr. } 14\text{ lb.} : 282\text{ l. } 2\text{ s.} :: 1\text{ lb.} : 3\text{ s. } 0\frac{1}{4}\frac{8}{18}\frac{6}{2}\text{ d.}$
- (64) $3\text{ s. } 0\frac{1}{4}\frac{8}{18}\frac{6}{2}\text{ d.} : 1\text{ lb.} :: 282\text{ l. } 2\text{ s.} : 1862\text{ lb.}$
 $= 16\text{ cwt. } 2\text{ qr. } 14\text{ lb.}$
- (65) First, 482 l. cost,
 173 charges,
 260 gain.

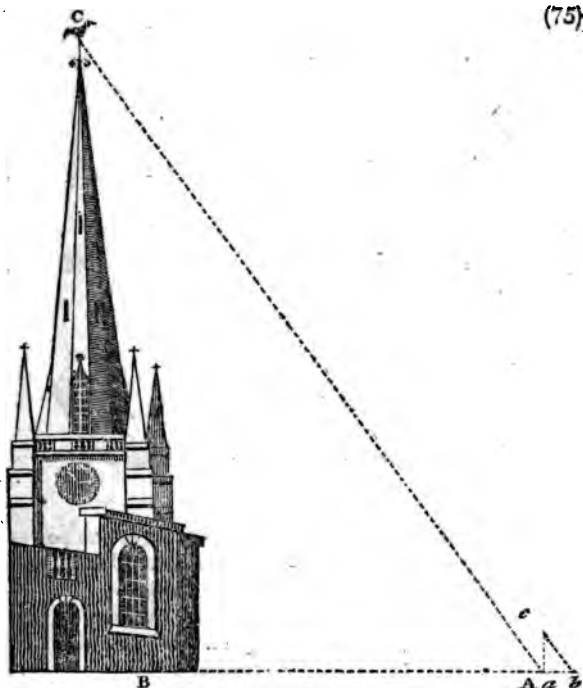
915 the whole is to be sold for:

- then $72\text{ tons} : 915\text{ l.} :: 12\text{ tons} : 152\text{ l. } 10\text{ s.}$
- (66) $152\text{ l. } 10\text{ s.} : 12\text{ tons} :: 915\text{ l.} : 72\text{ tons.}$
- (67) First, $180\text{ l.} - 15\text{ l.} = 165\text{ l. the whole must be sold for;}$
 $\text{then, } 400\text{ yds.} : 165\text{ l.} :: 1\text{ yd.} :: 8\text{ s. } 3\text{ d.}$
- (68) $8\text{ s. } 3\text{ d.} : 1\text{ yd.} :: 165\text{ l.} : 400\text{ yds.}$
- (69) First, $552 \times 85\frac{1}{2} = 47196\text{ yds.; then, } 57\text{ yds.} :$
 $47196\text{ yds.} :: 41\text{ yds.} : 33948\text{ yds.}$

THE RULE OF THREE DIRECT.

37

- (70) First, $552 \times 85\frac{1}{2} = 47196$ yds.; then 39948 yds. : 41 yds. :: 47196 yds. : 57 yds.
- (71) First, $3s. 4d.$: 1 ell. :: $443l. 6s. 8d.$: 2660 ells; then, $2660 \div 28 = 95$ pieces.
- (72) First, $95 \times 28 = 2660$ ells; then, 2660 ells : $443l. 6s. 8d.$:: 1 ell. : $3s. 4d.$
- (73) First, 1 ell = $1\frac{1}{4}$ yard; then, $9s. 6\frac{1}{2}d.$: $1\frac{1}{4}$ yd. :: $20l. 16s. 4\frac{1}{2}d.$: 54 yds. 1 qr. $2\frac{1}{2}\frac{2}{3}$ na.
- (74) 54 yds. 1 qr. $2\frac{1}{2}\frac{2}{3}$ na. : $20l. 16s. 4\frac{1}{2}d.$:: 1 ell : $9s. 6\frac{1}{2}d.$

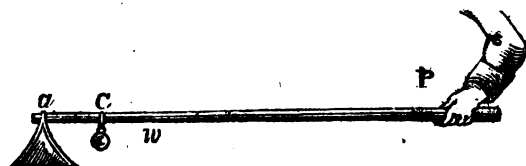


In the above figure $a c = 3$ feet 2 inches the length of the cane; $a b = 6$ feet 3 inches length of its shadow. Also $B C =$ the height of the steeple, and $A B = 144$ yards 2 feet 2 inches the length of its shadow.

38 THE RULE OF THREE DIRECT.

- (75) 6 ft. 3 in. : 3 ft. 2 in. :: 144 yds. 2 ft. 2 in.
: 73 yds. $11\frac{4}{5}$ in.
- (76) 73 yds. $11\frac{4}{5}$ in. : 144 yds. 2 ft. 2 in. :: 3 ft.
2 in. : 6 ft. 3 in.
- (77) 1 sec. : 1142 ft. :: $8\frac{1}{2}$ sec. : 9707 ft.
- (78) 9707 ft. : $8\frac{1}{2}$ sec. :: 1142 ft. : 1 sec.
- (79) 1 sec. : 1142 ft. :: 5 sec. : 5710 ft. = 1 mile
490 ft.
- (80) 5710 ft. : 5 sec. :: 1142 ft. : 1 sec.
- (81) 100*l.* : 4*l.* 10*s.* :: 96*l.* 4*s.* : 4*l.* 6*s.* $6\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}$ *d.*
- (82) 4*l.* 6*s.* $6\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}$ *d.* : 96*l.* 4*s.* :: 4*l.* 10*s.* :
100*l.*
- (83) First, 100*l.* + 4*l.* 10*s.* = 104*l.* 10*s.* amount of 100*l.*
for one year; then, 104*l.* 10*s.* : 4*l.* 10*s.* ::
146*l.* 10*s.* : 6*l.* 6*s.* $2\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}$ *d.*
- (84) 6*l.* 6*s.* $2\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}$ *d.* : 146*l.* 10*s.* :: 4*l.* 10*s.* :
104*l.* 10*s.*
- (85) 25262*l.* 12*s.* $4\frac{1}{2}$ *d.* : 12631*l.* 6*s.* $2\frac{1}{4}$ *d.* :: 1*l.** : 10*s.*
- (86) 10*s.* : 1*l.* :: 12631*l.* 6*s.* $2\frac{1}{4}$ *d.* : 25262*l.*
12*s.* $4\frac{1}{2}$ *d.*

(87)



Levers of the second order are such as have the power at one end P, the prop fixed directly at the other a, and weight w, somewhere between them, as at C.

First, 140 in. — $12\frac{1}{2}$ in. = $127\frac{1}{2}$ in. = Cb, the longest end of the lever; then, $12\frac{1}{2}$ in. : 186 lb. ::
 $127\frac{1}{2}$ in. : 1897*½* lb.

- (88) 1897*½* lb. : $127\frac{1}{2}$ in. :: 186 lb. : $12\frac{1}{2}$ in.

* 1*l.* is the 3rd term in the stating, and 10*s.* the fourth.

(89) 3 eggs : 1d. :: 864 eggs : $1\ 4\ 0$ { value of the eggs at
3 a-penny.
 $2\ 6\ 4$ both sorts sold for.

diff. $1\ 2\ 4$ { value of the eggs
at 2 a-penny.

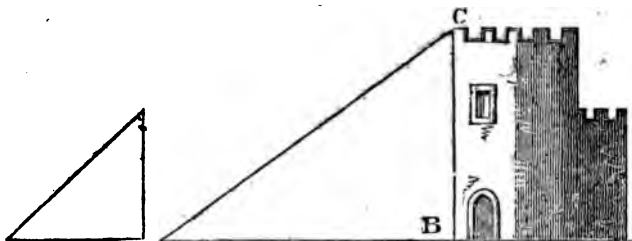
then, 1l. 2s. 4d. $\times 2 = 268d. \times 2 = 536$ eggs at 2 a-penny.

(90) First, 2 eggs : 1d. :: 536 eggs : $1\ 2\ 4$ { value of the eggs
at 2 a-penny.
 $2\ 6\ 4$ value of the whole.

diff. $1\ 4\ 0$ de. at 3 a-penny.

then, 1l. 4s. $\times 3 = 288d. \times 3 = 864$ eggs at 3 a-penny.

(91)



98 ft. 6 in. : 50 ft. 11 in. :: 581 ft. 7 in. :
300 ft. $7\ \frac{6\ 9\ 5}{118\ 2}$ in.

(92) 300 ft. $7\ \frac{6\ 9\ 5}{118\ 2}$ in. : 581 ft. 7 in. :: 50 ft. 11 in.
98 ft. 6 in.

(93) 23 hrs. 56 min. : 15540 miles :: 60 min. :
 $649\ \frac{1\ 2\ 8}{3\ 3}$ miles.

(94) $649\ \frac{1\ 2\ 8}{3\ 3}$ miles : 1 hr. :: 15540 miles : 23
hrs. 56 min.

(95) 33 min. 28 sec. : 12 digits :: 29 min. 28 sec.
: 10 deg. 33 min. $56\ \frac{1\ 6\ 4}{3\ 3\ 1}$ sec.

(96) 10 deg. 33 min. $56\ \frac{1\ 6\ 4}{3\ 3\ 1}$ sec. : 29 min. 28 sec.
: : 12 digits : 33 min. 28 sec.

- (97) First, $2290\text{ }l. 10s. + 3 = 763\text{ }l. 10s.$ value of the sugar;
 then, $1\text{ }l. 3s. 3d. : 1\text{ cwt.} :: 763\text{ }l. 10s. : 656\frac{2}{3}\text{ cwt.}$ sugar: again, $2290\text{ }l. 10s. - 763\text{ }l. 10s. = 1527\text{ }l.$ value of the wine; then, $43\text{ }l. 16s. : 1\text{ ton} :: 1527\text{ }l. : 34\frac{1}{8}\text{ tons}$ of wine.
- (98) First, $2290\text{ }l. 10s. + 3 = 763\text{ }l. 10s.$ value of the sugar;
 then, $656\frac{2}{3}\text{ cwt.} : 763\text{ }l. 10s. :: 1\text{ cwt.} : 1\text{ }l. 3s. 3d.$ the sugar per cwt: again, $2290\text{ }l. 10s. - 763\text{ }l. 10s. = 1527\text{ }l.$ value of the wine. Then $34\frac{1}{8}\text{ tons} : 1527\text{ }l. :: 1\text{ ton.} : 43\text{ }l. 16s.$ the wine per ton.
- (99) First, $4\text{ hound's} : 6\text{ hare's} :: 120\text{ hound's} : 180\text{ hare's paces}$; then, $4\text{ hound's} : 6\text{ hare's} :: 12\text{ hound's} : 18\text{ hare's paces}$, and $18\text{ hare's paces} - 16\text{ do.} = 2\text{ gain}$; hence, $2\text{ hare's} : 12\text{ hound's} :: 180\text{ hare's} : 1080\text{ hound's paces}$.
- (100) First, $12\text{ hound's} : 16\text{ hare's} : 4\text{ hound's} : 5\frac{1}{2}\text{ hare's paces}$; then, $6 - 5\frac{1}{2} = \frac{1}{2}\text{ hare's paces lost}$; and, $6\text{ hare's} : 4\text{ hound's} :: \frac{1}{2}\text{ hare's} : \frac{1}{3}\text{ hound's paces}$; whence, $4\text{ hound's} : \frac{1}{3}\text{ hound's} :: 1080\text{ hound's} : 120\text{ hound's paces}$ before the hare.

THE RULE OF THREE INVERSE.

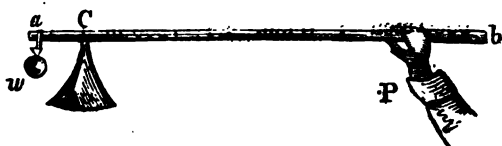
The first example is worked.

- (2) $3\text{ d.} : 6\text{ m.} :: 6\text{ d.} : 3\text{ men.}$
- (3) $18\text{ m.} : 30\text{ d.} :: 24\text{ m.} : 22\frac{1}{2}\text{ d.}$
- (4) $22\frac{1}{2}\text{ d.} : 24\text{ m.} :: 30\text{ d.} : 18\text{ m.}$
- (5) $12\text{ in.} : 12\text{ in.} :: 5\text{ in.} : 28\frac{1}{3}\text{ in.}$
- (6) $28\frac{1}{3}\text{ in. l.} : 5\text{ in. b.} :: 12\text{ in. l.} : 12\text{ in. b.}$
- (7) $90\text{ }l. : 540\text{ }l. :: 162\text{ }l. : 300\text{ }l.$
- (8) $300\text{ }l. : 162\text{ }l. :: 540\text{ }l. : 90\text{ }l.$
- (9) $5s. : 11\text{ oz. 8 dwt.} :: 9s. 6d. : 6\text{ oz.}$
- (10) $6\text{ oz.} : 9s. 6d. :: 11\text{ oz. 8 dwt.} : 5s.$

THE RULE OF THREE INVERSE. 41

- (11) 8 m. : 7200 sol. :: 6 m. : 9600 sol. would
consume the provisions in 6 months, hence 9600
- 7200 = 2400 sol. must be added.
- (12) 9600 men : 6 mo. :: 7200 men : 8 mo.
- (13) 18 w. : 48 h. :: 8 w. : 108 h.
- (14) 108 h. : 8 w. :: 48 h. : 18 w.
- (15) 14 d. : 68 m. :: 4 d. : 238 m.
- (16) 238 m. : 4 d. :: 68 m. : 14 d.
- (17) 7 ft. 3 in. : 69 ft. :: 27 in. : 74 yds. 4 in.
- (18) 74 yds. 4 in. : 27 in. :: 69 ft. 87 in.
- (19) 5 qrs. : 550 yds. :: 3 qrs. : 916½ yds.
- (20) 916½ yds. : 3 qrs. :: 550 yds. : 5 qrs.
- (21) 160l. : 30 yrs. :: 1200l. : 4 yrs.
- (22) 4 yrs. : 1200l. :: 30 yrs. 160l.
- (23) 20 men : 87 w. 3 d. :: 12 men : 145 w. 5 d.
- (24) 145 w. 5 d. : 12 men : 87 w. 3 d. : 20 m.
- (25) 8 p. b. : 20 p. l. :: 3 p. b. : 53½ p. l.
- (26) 53½ p. l. : 3 p. b. :: 20 p. l. : 8 p. b.
- (27) 200 sh. : 80 d. :: 800 sh. : 20 days.
- (28) 20 d. : 800 sh. :: 80 d. : 200 sh.
- (29) 45 c. : 4 w. :: 30 c. : 6 w.
- (30) 6 w. : 30 c. :: 4 w. : 45 c.
- (31) 16 ft. 3 in. : 18 ft. :: 2 ft. 6 in. : 117 ft.
= 39 yds.
- (32) 39 yds. : 2 ft. 6 in. :: 18 ft. : 16 ft. 3 in.
- (33) 80 miles : 15 cwt. 2 qr. 8 lb. :: 60 miles
: 20 cwt. 3 qrs. 1½ lb.
- (34) 20 cwt. 3 qrs. 1½ lb. : 60 miles :: 15 cwt.
2 qrs. 8 lb. : 80 miles.
- (35) 3 h. : 1 c. :: 7½ m. : 24 c.

$$(36) \quad 24 \text{ c.} : 7\frac{1}{2} \text{ m.} :: 1 \text{ c.} : 3 \text{ h.}$$



In the above Figure $a b = 120$ inches, $a C = 8$, P the power, or $1\frac{1}{4}$ cwt., and w the weight.

$$(37) \quad \text{First, } 120 \text{ in.} - 8 \text{ in.} = 112 \text{ in. } C P; \text{ then, } 112 \text{ in.} : 196 \text{ lb.} :: 8 \text{ in.} : 2744 \text{ lb.}$$

$$(38) \quad 2744 \text{ lb.} : 8 \text{ in.} :: 196 \text{ lb.} : 112 \text{ in.}$$

$$(39) \quad 5 \text{ ft. } 2 \text{ in.} : 9 \text{ ft. } 6 \text{ in.} :: 3 \text{ ft. } 4 \text{ in.} : 14 \text{ ft. } 8\frac{1}{6} \text{ in.}$$

$$(40) \quad 14 \text{ ft. } 8\frac{1}{6} \text{ in.} : 3 \text{ ft. } 4 \text{ in.} :: 9 \text{ ft. } 6 \text{ in.} : 5 \text{ ft. } 2 \text{ in.}$$

$$(41) \quad 9 \text{ h.} : 7 \text{ w.} :: 21 \text{ h.} : 3 \text{ w.}$$

$$(42) \quad 3 \text{ w.} : 21 \text{ h.} :: 7 \text{ w.} : 9 \text{ h.}$$

NOTE. Any question in the Rule of Three Inverse may be so stated, as to have its terms in direct proportion, by changing the places of the first and third terms in the question; thus, in the last example, $7 \text{ w.} : 21 \text{ h.} :: 3 \text{ w.} : 9 \text{ h.}$, as above.

COMPOUND PROPORTION.

Ex. (1) is worked.

$$(2) \quad \text{First, } *32 \text{ h.} : 24 \text{ b.} :: 16 \text{ h.}$$

$$*8 \text{ d.} : \text{—} :: 6 \text{ d.}$$

$$\text{then } \frac{24 \times 16 \times 6}{32 \times 8} = \frac{2304}{256} = 9 \text{ bus.}$$

Or, by two statings, thus,

$$\text{First, } 32 \text{ h.} : 24 \text{ b.} :: 16 \text{ h.} : 12 \text{ b., the 4th term;}$$

$$\text{then, } 8 \text{ d.} : 12 \text{ b.} :: 6 \text{ d.} : 9 \text{ b., as before.}$$

In a similar manner may all the succeeding questions be stated.

COMPOUND PROPORTION.

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$$\begin{array}{l}
 (3) \text{ First, } *40 \text{ s.} : 24\text{ l.} :: 1500 \text{ s.} \\
 \quad \quad *36 \text{ d.} : - :: 32 \text{ d.} \\
 \quad \quad 24 \times 1500 \times 32 \quad 1152000 \\
 \text{then, } \frac{\quad}{40 \times 36} = \frac{\quad}{1440} = 800\text{ l.}
 \end{array}$$

$$\begin{array}{l}
 (4) \text{ First, } *800\text{ l.} : 1500 \text{ m.} :: 24\text{ l.} \\
 \quad \quad *36 \text{ d.} : - :: 32 \text{ d.} \\
 \quad \quad 1500 \times 24 \times 32 \quad 1152000 \\
 \text{then, } \frac{\quad}{800 \times 36} = \frac{\quad}{28800} = 40 \text{ m.}
 \end{array}$$

$$\begin{array}{l}
 (5) \text{ First, } 9000 \text{ d.} : 14 \text{ f. l.} :: 12^* \text{ f. l.} \\
 \quad \quad - : 2\frac{1}{2} \text{ i. t.} :: 1\frac{1}{2}^* \text{ i. t.} \\
 \text{Here, } 2\frac{1}{2} = 5 \text{ halves, and } 1\frac{1}{2} = 3 \text{ halves;} \\
 \quad \quad 9000 \times 14 \times 5 \quad 630000 \\
 \text{then, } \frac{\quad}{12 \times 3} = \frac{\quad}{86} = 17500 \text{ deals.}
 \end{array}$$

$$\begin{array}{l}
 (6) \text{ } 17500 \text{ d.} : 12 \text{ f. l.} :: 14^* \text{ l.} \\
 \quad \quad - : 1\frac{1}{2} \text{ i. t.} :: 2\frac{1}{2}^* \text{ i. t.} \\
 \text{Here, } 1\frac{1}{2} = 3 \text{ halves, and } 2\frac{1}{2} = 5 \text{ halves.} \\
 \quad \quad 17500 \times 12 \times 3 \quad 630000 \\
 \text{then, } \frac{\quad}{14 \times 5} = \frac{\quad}{70} = 9000 \text{ deals.}
 \end{array}$$

$$\begin{array}{l}
 (7) \text{ First, } 12000 \text{ m.} : 15 \text{ ozs.} :: 10000^* \text{ m.} \\
 \quad \quad 32 \text{ w.} : - :: 48^* \text{ w.} \\
 \quad \quad 12000 \times 15 \times 32 \quad 5760000 \\
 \text{then, } \frac{\quad}{10000 \times 48} = \frac{\quad}{480000} = 12 \text{ ozs.}
 \end{array}$$

$$\begin{array}{l}
 (8) \text{ First, } 10000 \text{ m.} : 12 \text{ ozs.} :: 12000^* \text{ m.} \\
 \quad \quad 48 \text{ w.} : - :: 32^* \text{ w.} \\
 \quad \quad 10000 \times 12 \times 48 \quad 5760000 \\
 \text{then, } \frac{\quad}{12000 \times 32} = \frac{\quad}{384000} = 15 \text{ ozs.}
 \end{array}$$

$$\begin{array}{l}
 (9) \text{ First, } *27 \text{ m.} : 36\text{ l.} :: 72 \text{ m.} \\
 \quad \quad *24 \text{ w.} : - :: 48 \text{ w.} \\
 \quad \quad 36 \times 72 \times 48 \quad 124416 \\
 \text{then, } \frac{\quad}{27 \times 24} = \frac{\quad}{648} = 192\text{ l.}
 \end{array}$$

COMPOUND PROPORTION.

$$\begin{array}{lcl}
 (10) & *72 \text{ s.} : 192\text{l.} & :: 27 \text{ s.} \\
 & *48 \text{ w.} : \text{---} & :: 24 \text{ w.} \\
 & 192 \times 27 \times 24 & 124416 \\
 \text{then, } & \frac{\text{---}}{72 \times 48} = \frac{\text{---}}{3456} & = 36\text{l.}
 \end{array}$$

$$\begin{array}{lcl}
 (11) & *100\text{l.} : 5\text{l.} & :: 144\text{l.} \\
 & *365 \text{ d.} : \text{---} & :: 486 \text{ d.} \\
 & 5 \times 144 \times 486 & 349920 \\
 \text{then, } & \frac{\text{---}}{100 \times 365} = \frac{\text{---}}{36500} & = 9\text{l. } 11\text{s. } 8\frac{1}{4} \frac{13}{16} \text{d.}
 \end{array}$$

$$\begin{array}{lcl}
 (12) & *144\text{l.} : 9\text{l. } 11\text{s. } 8\frac{1}{4} \frac{13}{16} \text{d.} & :: 100\text{l.} \\
 & *486 \text{ d.} : \text{---} & :: 365 \text{ d.} \\
 \text{First, } & 9\text{l. } 11\text{s. } 8\frac{1}{4} \frac{13}{16} \text{d.} = 3359095 \text{ three hundred and} \\
 & \text{sixty fifths of a farthing; then,} \\
 & \frac{3359095 \times 100 \times 365}{144 \times 486} = \frac{122611968000}{69984} = 1752000 \text{ three}
 \end{array}$$

hundred and sixty fifths of a farthing, which, being reduced, gives 5\text{l.} the ans.

$$\begin{array}{lcl}
 (13) & *6\text{d.} : 12\text{d.} & :: 4\text{d.} \\
 & *8 \text{ p.} : \text{---} & :: 40 \text{ p.} \\
 & 12 \times 4 \times 40 & 1920 \\
 \text{then, } & \frac{\text{---}}{6 \times 8} = \frac{\text{---}}{48} & = 40\text{d.}
 \end{array}$$

$$\begin{array}{lcl}
 (14) & 12 \text{ m.} : 100\text{l.} & :: 8^* \text{ m.} \\
 & *5 & :: 10\text{l.} \\
 & 100 \times 12 \times 10 & 12000 \\
 \text{then, } & \frac{\text{---}}{5 \times 8} = \frac{\text{---}}{40} & = 300\text{l.}
 \end{array}$$

$$\begin{array}{lcl}
 (15) & 8 \text{ m.} : 300\text{l.} & :: 12^* \text{ m.} \\
 & *10\text{l.} : \text{---} & :: 5\text{l.} \\
 & 8 \times 300 \times 5 & 12000 \\
 \text{then, } & \frac{\text{---}}{12 \times 10} = \frac{\text{---}}{120} & = 100\text{l.}
 \end{array}$$

PRACTICE.

45

(16)

248 m.	:	5 d.	:	:	24 m.	*
11 h.	—				9 h.	*
7 d.	—				4 d.	*
* 232 y. l.	—				337 y. l.	
* 4 w.	—				5 w.	
* 3 d.	—				4 d.	

then,

$$\frac{248 \times 11 \times 7 \times 5 \times 337 \times 5 \times 4}{232 \times 4 \times 3 \times 24 \times 9 \times 4} = \frac{643535200}{2805376} = 267\frac{1}{2} \text{ ds.}$$

(17)

4 c.	:	16 d.	:	:	9 c.	*
12 h.	—				10 h.	*
* 14 s.	—				30 s.	
* 24 p.	—				16 p.	
* 44 l.	—				50 l.	
* 40 let.	—				45 let.	

then,

$$\frac{16 \times 4 \times 12 \times 30 \times 16 \times 50 \times 45}{9 \times 10 \times 14 \times 24 \times 44 \times 40} = \frac{829440000}{53222400} = 15\frac{1}{2} \text{ ds.}$$

PRACTICE.

Example (1) is worked.

(2)

$$\begin{array}{r|l} 2 & 2446 \text{ at } \frac{1}{2}d. \\ \hline 12 & 1223 \\ \hline 2|0 & 10|1 \text{ } 11d. \\ \hline \text{£} & 5 \text{ } 1 \text{ } 11 \text{ Ans.} \end{array}$$

(3)

$$\begin{array}{r|l} d. & \frac{1}{2} = \frac{1}{2} \\ \hline & 1426 \text{ at } \frac{1}{4}d. \\ \hline & 713 \\ & 356 \text{ } 6d. \\ \hline 12 & 1069 \text{ } 6 \\ \hline 2|0 & 8|9 \text{ } 1\frac{1}{2} \\ \hline \text{£.} & 4 \text{ } 9 \text{ } 1\frac{1}{2} \end{array}$$

$$\begin{array}{r|l} 12 & 1436 \text{ at } 1d. \\ 2|0 & \underline{11|9 \ 8} \\ \hline \pounds & \underline{5 \ 19 \ 8} \end{array}$$

$$\begin{array}{r|l} d. & (5) \\ 1\frac{1}{2} = \frac{1}{\frac{1}{2}} & 3224 \text{ at } 1\frac{1}{2}d. \\ 2|0 & \underline{40|3} \\ \hline \pounds & \underline{20 \ 8 \ 0} \end{array}$$

$$\begin{array}{r|l} d. & (6) \\ 2 = \frac{1}{\frac{1}{2}} & 3640 \text{ at } 2d. \\ 2|0 & \underline{60|6 \ 8} \\ \hline & \underline{30 \ 6 \ 8} \end{array}$$

$$\begin{array}{r|l} d. & (7) \\ 3 = \frac{1}{\frac{1}{3}} & 642 \text{ at } 3d. \\ 2|0 & \underline{16|0 \ 6} \\ \hline & \underline{8 \ 0 \ 6} \end{array}$$

$$\begin{array}{r|l} d. & (8) \\ 4 = \frac{1}{\frac{1}{4}} & 3641 \text{ at } 4d. \\ 2|0 & \underline{121|3 \ 8} \\ \hline & \underline{60 \ 13 \ 8} \end{array}$$

$$\begin{array}{r|l} d. & (9) \\ 6 = \frac{1}{\frac{1}{6}} & 341 \text{ at } 6d. \\ 2|0 & \underline{17|0 \ 6} \\ \hline & \underline{8 \ 10 \ 6} \end{array}$$

$$\begin{array}{r|l} s. d. & (10) \\ 1 \ 8 = \frac{1}{\frac{1}{8}} & 346 \text{ at } 1s. \ 8d. \\ & \underline{28 \ 16 \ 8} \end{array}$$

$$\begin{array}{r|l} s. & (11) \\ 2 = \frac{1}{\frac{1}{2}} & 842 \text{ at } 2s. * \\ & \underline{84 \ 4 \ 0} \end{array}$$

$$\begin{array}{r|l} s. d. & (12) \\ 2 \ 6 = \frac{1}{\frac{1}{6}} & 480 \text{ at } 2s. \ 6d. \\ & \underline{60} \end{array}$$

$$\begin{array}{r|l} s. d. & (13) \\ 3 \ 4 = \frac{1}{\frac{1}{4}} & 962 \text{ at } 3s. \ 4d. \\ & \underline{160 \ 6 \ 8} \end{array}$$

* When the price is 2s. double the units' figure for shillings, and the rest of the product will be pounds.

$$\begin{array}{r} \text{s.} \\ 4 = \frac{1}{2} \end{array} \left| \begin{array}{l} (14) \\ 4060 \text{ at } 4\text{s.} \\ \hline \text{£} \quad 812 \end{array} \right.$$

$$\begin{array}{r} \text{s.} \\ 5 = \frac{1}{4} \end{array} \left| \begin{array}{l} (15) \\ 120 \text{ at } 5\text{s} \\ \hline \text{£} \quad 30 \end{array} \right.$$

$$\begin{array}{r} \text{s. d.} \\ 6 \text{ } 8 = \frac{1}{2} \end{array} \left| \begin{array}{l} (16) \\ 904 \text{ at } 6\text{s. } 8\text{d.} \\ \hline 301 \text{ } 6 \text{ } 8 \end{array} \right.$$

$$\begin{array}{r} \text{s.} \\ 10 = \frac{1}{2} \end{array} \left| \begin{array}{l} (17) \\ 4116 \text{ at } 10\text{s.} \\ \hline 2058 \end{array} \right.$$

RULE II.

Example (18) is worked.

$$\begin{array}{r} \text{d.} \\ 1\frac{1}{2} = \frac{1}{8} \end{array} \left| \begin{array}{l} (19) \\ 342 \text{ at } 1\frac{1}{2}\text{d.} \\ \hline \frac{1}{4} = \frac{1}{8} \quad 42 \text{ } 9 \\ \quad \quad 7 \text{ } 1\frac{1}{2} \\ \hline 2|0 \quad 4|9 \text{ } 10\frac{1}{2} \\ \hline 2 \text{ } 9 \text{ } 10\frac{1}{2} \end{array} \right.$$

$$\begin{array}{r} \text{d.} \\ 2 = \frac{1}{4} \end{array} \left| \begin{array}{l} (20) \\ 94 \text{ at } 2\frac{1}{4}\text{d.} \\ \hline \frac{1}{4} = \frac{1}{8} \quad 15 \text{ } 8 \\ \quad \quad 1 \text{ } 11\frac{1}{2} \\ \hline \text{s.} \quad 17 \text{ } 7\frac{1}{2} \end{array} \right.$$

$$\begin{array}{r} \text{d.} \\ 2 = \frac{1}{4} \end{array} \left| \begin{array}{l} (21) \\ 342 \text{ at } 2\frac{1}{2}\text{d.} \\ \hline \frac{1}{2} = \frac{1}{4} \quad 57 \\ \quad \quad 14 \text{ } 3 \\ \hline 2|0 \quad 7|1 \text{ } 3 \\ \hline 3 \text{ } 11 \text{ } 3 \end{array} \right.$$

$$\begin{array}{r} \text{d.} \\ 2 = \frac{1}{4} \end{array} \left| \begin{array}{l} (22) \\ 432 \text{ at } 2\frac{1}{4}\text{d.} \\ \hline \frac{1}{2} = \frac{1}{4} \quad 72 \\ \frac{1}{4} = \frac{1}{2} \quad 18 \\ \quad \quad 9 \\ \hline 2|0 \quad 9|9 \\ \hline 4 \text{ } 19 \end{array} \right.$$

$$\begin{array}{r}
 d. \quad (35) \\
 6 = \frac{1}{2} \quad | \quad 984 \text{ at } 6\frac{3}{4}d. \\
 \hline
 \frac{1}{2} = \frac{1}{2} \quad | \quad 492 \\
 \frac{1}{4} = \frac{1}{4} \quad | \quad 41 \\
 \hline
 \quad \quad | \quad 20 \quad 6 \\
 2|0 \quad | \quad 55|3 \quad 6 \\
 \hline
 \mathcal{L} \quad | \quad 27 \quad 13 \quad 6 \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 d. \quad (36) \\
 6 = \frac{1}{2} \quad | \quad 842 \text{ at } 7d. \\
 \hline
 1 = \frac{1}{6} \quad | \quad 421 \\
 \quad \quad | \quad 70 \quad 2 \\
 \hline
 2|0 \quad | \quad 49|1 \quad 2 \\
 \hline
 \mathcal{L} \quad | \quad 24 \quad 11 \quad 2 \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 d. \quad (37) \\
 6 = \frac{1}{2} \quad | \quad 436 \text{ at } 7\frac{1}{4}d. \\
 \hline
 1 = \frac{1}{6} \quad | \quad 218 \\
 \frac{1}{4} = \frac{1}{4} \quad | \quad 36 \quad 4 \\
 \quad \quad | \quad 9 \quad 1 \\
 \hline
 2|0 \quad | \quad 26|3 \quad 5 \\
 \hline
 \quad \quad | \quad 13 \quad 3 \quad 5 \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 d. \quad (38) \\
 6 = \frac{1}{2} \quad | \quad 4160 \text{ at } 7\frac{1}{2}d. \\
 \hline
 1 = \frac{1}{6} \quad | \quad 2080 \\
 \frac{1}{2} = \frac{1}{2} \quad | \quad 346 \quad 8 \\
 \quad \quad | \quad 173 \quad 4 \\
 \hline
 2|0 \quad | \quad 260 \quad 0 \quad 0 \\
 \hline
 \quad \quad | \quad 130 \quad 0 \quad 0 \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 d. \quad (39) \\
 6 = \frac{1}{2} \quad | \quad 896 \text{ at } 7\frac{3}{4}d. \\
 \hline
 1 = \frac{1}{6} \quad | \quad 448 \\
 \frac{1}{2} = \frac{1}{2} \quad | \quad 74 \quad 8 \\
 \frac{1}{4} = \frac{1}{4} \quad | \quad 37 \quad 4 \\
 \quad \quad | \quad 18 \quad 8 \\
 \hline
 2|0 \quad | \quad 57|8 \quad 8 \\
 \hline
 \quad \quad | \quad 28 \quad 18 \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 d. \quad (40) \\
 6 = \frac{1}{2} \quad | \quad 4960 \text{ at } 8d. \\
 \hline
 2 = \frac{1}{3} \quad | \quad 2480 \\
 \quad \quad | \quad 826 \quad 8 \\
 \hline
 2|0 \quad | \quad 330|6 \quad 8 \\
 \hline
 \quad \quad | \quad 165 \quad 6 \quad 8 \\
 \hline
 \end{array}$$

PRACTICE.

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$$\begin{array}{r|l}
 d. & (41) \\
 6 = \frac{1}{2} & 960 \text{ at } 8\frac{1}{4}d. \\
 \hline
 2 = \frac{1}{3} & 480 \\
 \frac{1}{4} = \frac{1}{8} & 160 \\
 & 20 \\
 \hline
 2|0 & 66|0 \\
 \hline
 \mathcal{L} & 33
 \end{array}$$

$$\begin{array}{r|l}
 d. & (42) \\
 6 = \frac{1}{2} & 842 \text{ at } 8\frac{1}{2}d. \\
 \hline
 2 = \frac{1}{3} & 421 \\
 \frac{1}{2} = \frac{1}{4} & 140 \quad 4 \\
 & 35 \quad 1 \\
 \hline
 2|0 & 59|6 \quad 5 \\
 \hline
 \mathcal{L} & 29 \quad 16 \quad 5
 \end{array}$$

$$\begin{array}{r|l}
 d. & (43) \\
 6 = \frac{1}{2} & 123 \text{ at } 8\frac{1}{4}d. \\
 \hline
 2 = \frac{1}{3} & 61 \quad 6 \\
 \frac{1}{2} = \frac{1}{4} & 20 \quad 6 \\
 \frac{1}{4} = \frac{1}{2} & 5 \quad 1\frac{1}{2} \\
 & 2 \quad 6\frac{1}{4} \\
 \hline
 2|0 & 8|9 \quad 8\frac{1}{4} \\
 \hline
 & 4 \quad 9 \quad 8\frac{1}{4}
 \end{array}$$

$$\begin{array}{r|l}
 d. & (44) \\
 6 = \frac{1}{2} & 842 \text{ at } 9d. \\
 \hline
 3 = \frac{1}{2} & 421 \\
 & 210 \quad 6 \\
 \hline
 2|0 & 63|1 \quad 6 \\
 \hline
 & 31 \quad 11 \quad 6
 \end{array}$$

$$\begin{array}{r|l}
 d. & (45) \\
 6 = \frac{1}{2} & 786 \text{ at } 9\frac{1}{4}d. \\
 \hline
 3 = \frac{1}{2} & 393 \\
 \frac{1}{4} = \frac{1}{2} & 196 \quad 6 \\
 & 16 \quad 4\frac{1}{2} \\
 \hline
 2|0 & 60|5 \quad 10\frac{1}{2} \\
 \hline
 & 30 \quad 5 \quad 10\frac{1}{2}
 \end{array}$$

$$\begin{array}{r|l}
 d. & (46) \\
 6 = \frac{1}{2} & 1212 \text{ at } 9\frac{1}{2} \\
 \hline
 3 = \frac{1}{2} & 606 \\
 \frac{1}{2} = \frac{1}{4} & 303 \\
 & 50 \quad 6 \\
 \hline
 2|0 & 95|9 \quad 6 \\
 \hline
 & 47 \quad 19 \quad 6
 \end{array}$$

$$\begin{array}{r|l}
 d. & (47) \\
 6 = \frac{1}{2} & 644 \text{ at } 9\frac{3}{4}d. \\
 \hline
 3 = \frac{1}{2} & 322 \\
 1 = \frac{1}{4} & 161 \\
 & 40 \quad 3 \\
 \hline
 2|0 & 52|3 \quad 3 \\
 \hline
 \mathcal{L} & 26 \quad 3 \quad 3
 \end{array}$$

$$\begin{array}{r|l}
 d. & (48) \\
 6 = \frac{1}{2} & 596 \text{ at } 10d. \\
 \hline
 3 = \frac{1}{2} & 298 \\
 1 = \frac{1}{3} & 149 \\
 & 49 \quad 8 \\
 \hline
 2|0 & 49|6 \quad 8 \\
 \hline
 \mathcal{L} & 24 \quad 16 \quad 8
 \end{array}$$

$$\begin{array}{r|l}
 d. & (49) \\
 6 = \frac{1}{2} & 742 \text{ at } 10\frac{1}{4}d. \\
 \hline
 3 = \frac{1}{2} & 371 \\
 1 = \frac{1}{3} & 185 \quad 6 \\
 \frac{1}{4} = \frac{1}{4} & 61 \quad 10 \\
 & 15 \quad 5\frac{1}{2} \\
 \hline
 2|0 & 63|3 \quad 9\frac{1}{2} \\
 \hline
 & 31 \quad 13 \quad 9\frac{1}{2}
 \end{array}$$

$$\begin{array}{r|l}
 d. & (50) \\
 6 = \frac{1}{2} & 412 \text{ at } 10\frac{1}{2}d. \\
 \hline
 3 = \frac{1}{2} & 206 \\
 1 = \frac{1}{3} & 103 \\
 \frac{1}{2} = \frac{1}{2} & 34 \quad 4 \\
 & 17 \quad 2 \\
 \hline
 2|0 & 36|0 \quad 6 \\
 \hline
 & 18 \quad 0 \quad 6
 \end{array}$$

$$\begin{array}{r|l}
 d. & (51) \\
 6 = \frac{1}{2} & 680 \text{ at } 10\frac{3}{4}d. \\
 \hline
 3 = \frac{1}{2} & 340 \\
 1 = \frac{1}{3} & 170 \\
 \frac{1}{2} = \frac{1}{2} & 56 \quad 8 \\
 \frac{1}{4} = \frac{1}{4} & 28 \quad 4 \\
 & 14 \quad 2 \\
 \hline
 2|0 & 60|9 \quad 2 \\
 \hline
 & 30 \quad 9 \quad 2
 \end{array}$$

$$\begin{array}{r|l}
 d. & (52) \\
 6 = \frac{1}{2} & 1234 \text{ at } 11d. \\
 \hline
 3 = \frac{1}{2} & 617 \\
 1\frac{1}{2} = \frac{1}{2} & 308 \quad 6 \\
 \frac{1}{2} = \frac{1}{3} & 154 \quad 3 \\
 & 51 \quad 5 \\
 \hline
 2|0 & 113|1 \quad 2 \\
 \hline
 & 56 \quad 11 \quad 2
 \end{array}$$

$$\begin{array}{r|l}
 \text{d.} & (53) \\
 6 = \frac{1}{2} & 3620 \text{ at } 11\frac{1}{4}d. \\
 \hline
 3 = \frac{1}{2} & 1810 \\
 1\frac{1}{2} = \frac{1}{2} & 905 \\
 \frac{3}{4} = \frac{1}{2} & 452 \quad 6 \\
 & 226 \quad 3 \\
 \hline
 2|0 & 339 \quad 3 \quad 9 \\
 \hline
 \text{£} & 169 \quad 13 \quad 9
 \end{array}$$

$$\begin{array}{r|l}
 \text{d.} & (54) \\
 6 = \frac{1}{2} & 684 \text{ at } 11\frac{1}{4}d. \\
 \hline
 3 = \frac{1}{2} & 342 \\
 1\frac{1}{2} = \frac{1}{2} & 171 \\
 \frac{3}{4} = \frac{1}{2} & 85 \quad 6 \\
 \frac{1}{4} = \frac{1}{2} & 42 \quad 9 \\
 & 14 \quad 3 \\
 \hline
 2|0 & 65 \quad 5 \quad 6 \\
 \hline
 \text{£} & 32 \quad 15 \quad 6
 \end{array}$$

$$\begin{array}{r|l}
 \text{d.} & (55) \\
 8 = \frac{1}{3} & 962 \text{ at } 11\frac{1}{4}d. \\
 \hline
 2 = \frac{1}{3} & 32 \quad 1 \quad 4 \\
 1 = \frac{1}{3} & 8 \quad 0 \quad 4 \\
 \frac{1}{2} = \frac{1}{3} & 4 \quad 0 \quad 2 \\
 \frac{1}{4} = \frac{1}{3} & 2 \quad 0 \quad 1 \\
 & 1 \quad 0 \quad 0\frac{1}{2} \\
 \hline
 \text{£} & 47 \quad 1 \quad 11\frac{1}{2}
 \end{array}$$

* In some cases, it will be more convenient (to find the answer at 2s. as in note page 61, and divide that sum by its aliquot parts

RULE III.

Example (56) is worked.

<p><i>d.</i> (57) $4 = \frac{1}{3}$ 1241 at 2s. 5d. 2 <hr style="width: 100px; margin: 5px 0;"/> 2482 $1 = \frac{1}{4}$ 413 8 103 5 <hr style="width: 100px; margin: 5px 0;"/> 2 0 299 9 1 <hr style="width: 100px; margin: 5px 0;"/> £ 149 19 1 <hr style="width: 100px; margin: 5px 0;"/></p>	<p><i>d.</i> (58) $6 = \frac{1}{2}$ 486 at 3s. 8d. 3 <hr style="width: 100px; margin: 5px 0;"/> 1458 $2 = \frac{1}{3}$ 243 81 <hr style="width: 100px; margin: 5px 0;"/> 2 0 178 2 <hr style="width: 100px; margin: 5px 0;"/> £ 89 2 0 <hr style="width: 100px; margin: 5px 0;"/></p>
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<p><i>d.</i> (59) $3 = \frac{1}{4}$ 642 at 4s. 3d. 4 <hr style="width: 100px; margin: 5px 0;"/> 2568 160 6 <hr style="width: 100px; margin: 5px 0;"/> 2 0 272 8 6 <hr style="width: 100px; margin: 5px 0;"/> 136 8 6 <hr style="width: 100px; margin: 5px 0;"/></p>	<p><i>d.</i> (60) $6 = \frac{1}{2}$ 543 at 5s. 11d. 5 <hr style="width: 100px; margin: 5px 0;"/> 2715 $3 = \frac{1}{2}$ 271 6 $1\frac{1}{2} = \frac{1}{3}$ 135 9 $\frac{1}{2} = \frac{1}{3}$ 67 10½ 22 7½ <hr style="width: 100px; margin: 5px 0;"/> 2 0 321 2 9 <hr style="width: 100px; margin: 5px 0;"/> 160 12 9 <hr style="width: 100px; margin: 5px 0;"/></p>
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$$\begin{array}{r|l}
 d. & (61) \\
 6 = \frac{1}{2} & 48 \text{ at } 6s. 10\frac{1}{2}d. \\
 & 6 \\
 \hline
 & 288 \\
 3 = \frac{1}{2} & 24 \\
 1 = \frac{1}{2} & 12 \\
 \frac{1}{2} = \frac{1}{2} & 4 \\
 & 2 \\
 \hline
 2|0 & 33|0 \\
 \hline
 \mathcal{L} & 16 \ 10 \ 0
 \end{array}$$

$$\begin{array}{r|l}
 d. & (62) \\
 6 = \frac{1}{2} & 412 \text{ at } 7s. 7d. \\
 & 7 \\
 \hline
 & 2884 \\
 1 = \frac{1}{2} & 206 \\
 & 34 \ 4 \\
 \hline
 2|0 & 312|4 \ 4 \\
 \hline
 \mathcal{L} & 156 \ 4 \ 4
 \end{array}$$

$$\begin{array}{r|l}
 d. \frac{1}{2} & (63) \\
 3 = \frac{1}{2} & 141 \text{ at } 8s. 3\frac{1}{2}d. \\
 & 8 \\
 \hline
 & 1128 \\
 \frac{1}{2} = \frac{1}{2} & 35 \ 3 \\
 & 2 \ 11\frac{1}{2} \\
 \hline
 2|0 & 116|6 \ 2\frac{1}{2} \\
 \hline
 & 58 \ 6 \ 2\frac{1}{2}
 \end{array}$$

$$\begin{array}{r|l}
 d. & (64) \\
 6 = \frac{1}{2} & 364 \text{ at } 9s. 7\frac{1}{2}d. \\
 & 9 \\
 \hline
 & 3276 \\
 1 = \frac{1}{2} & 182 \\
 \frac{1}{2} = \frac{1}{2} & 30 \ 4 \\
 & 15 \ 2 \\
 \hline
 2|0 & 350|3 \ 6 \\
 \hline
 & 175 \ 3 \ 6
 \end{array}$$

$$\begin{array}{r|l}
 d. & (65) \\
 4 = \frac{1}{2} & 891 \text{ at } 10s. 5\frac{1}{2}d. \\
 & 10 \\
 \hline
 & 8910 \\
 1 = \frac{1}{2} & 297 \\
 \frac{1}{2} = \frac{1}{2} & 74 \ 3 \\
 & 18 \ 6\frac{3}{4} \\
 \hline
 2|0 & 929|9 \ 9\frac{3}{4} \\
 \hline
 & 464 \ 19 \ 9\frac{3}{4}
 \end{array}$$

$$\begin{array}{r|l}
 d. & (66) \\
 6 = \frac{1}{2} & 401 \text{ at } 11s. 9\frac{1}{2}d. \\
 & 11 \\
 \hline
 & 4411 \\
 3 = \frac{1}{2} & 200 \ 6 \\
 \frac{1}{2} = \frac{1}{2} & 100 \ 3 \\
 & 16 \ 8\frac{1}{2} \\
 \hline
 2|0 & 472|8 \ 5\frac{1}{2} \\
 \hline
 & 236 \ 8 \ 5\frac{1}{2}
 \end{array}$$

$\begin{array}{r} d. \\ 6 = \frac{1}{2} \end{array} \left \begin{array}{l} (67) \\ 481 \text{ at } 12s. 8d. \\ 12 \\ \hline 5772 \\ 240 \quad 6 \\ 80 \quad 2 \\ \hline 2 0 \quad 609 2 \quad 8 \\ \hline \pounds \quad 304 \quad 12 \quad 8 \end{array} \right.$	$\begin{array}{r} d. \\ 6 = \frac{1}{2} \end{array} \left \begin{array}{l} (68) \\ 801 \text{ at } 13s. 6d. \\ 13 \\ \hline 10413 \\ 400 \quad 6 \\ \hline 2 0 \quad 1081 3 \quad 6 \\ \hline \pounds \quad 540 \quad 13 \quad 6 \end{array} \right.$
--	--

$\begin{array}{r} d. \\ 6 = \frac{1}{2} \end{array} \left \begin{array}{l} (69) \\ 482 \text{ at } 14s. 8d. \\ 14 \\ \hline 6748 \\ 241 \\ 80 \quad 4 \\ \hline 2 0 \quad 706 9 \quad 4 \\ \hline 353 \quad 9 \quad 4 \end{array} \right.$	$\begin{array}{r} d. \\ 6 = \frac{1}{2} \end{array} \left \begin{array}{l} (70) \\ 921 \text{ at } 15s. 9d. \\ 15 \\ \hline 4815 \\ 160 \quad 6 \\ 80 \quad 3 \\ \hline 2 0 \quad 505 5 \quad 9 \\ \hline 252 \quad 15 \quad 9 \end{array} \right.$
---	--

$\begin{array}{r} d. \\ 6 = \frac{1}{2} \end{array} \left \begin{array}{l} (71) \\ 218 \text{ at } 16s. 10d. \\ 16 \\ \hline 3488 \\ 109 \\ 54 \quad 6 \\ 18 \quad 2 \\ \hline 2 0 \quad 366 9 \quad 8 \\ \hline 183 \quad 9 \quad 8 \end{array} \right.$	$\begin{array}{r} d. \\ 4 = \frac{1}{2} \end{array} \left \begin{array}{l} (72) \\ 466 \text{ at } 17s. 4d. \\ 17 \\ \hline 7922 \\ 155 \quad 4 \\ \hline 2 0 \quad 807 7 \quad 4 \\ \hline 403 \quad 17 \quad 4 \end{array} \right.$
--	--

d	(73)	$d.$	(74)
$6 = \frac{1}{2}$	621 at 18s. 6d. 18	$6 = \frac{1}{2}$	123 at 19s. 10 $\frac{1}{2}$ d. 19
	<hr/>		<hr/>
	11178		2397
	310 6	$3 = \frac{1}{2}$	61 6
	<hr/>	$1 = \frac{1}{3}$	30 9
2 0	1148 8 6	$\frac{1}{2} = \frac{1}{2}$	10 3
	<hr/>		5 1 $\frac{1}{2}$
\mathcal{L}	574. 8 6		<hr/>
	<hr/>	2 0	244 4 7 $\frac{1}{2}$
			<hr/>
		\mathcal{L}	122 4 7 $\frac{1}{2}$
			<hr/>

RULE IV

Example (75) is worked.

$s.$	$d.$	(76)	$s.$	(77)
10	0 = $\frac{1}{2}$	412 at 1l. 16s. 7d.	10 = $\frac{1}{2}$	244 at 2l. 10s
5	0 = $\frac{1}{2}$	206		2
1	0 = $\frac{1}{2}$	103		<hr/>
0	6 = $\frac{1}{2}$	20 12		488
0	1 = $\frac{1}{6}$	10 6		122
		1 14 4		<hr/>
		<hr/>		610
		753 12 4		<hr/>

$s.$	(78)	$s.$	(79)
10 = $\frac{1}{2}$	321 at 3l. 15s. 3	10 = $\frac{1}{2}$	412 at 4l. 16s 4
	<hr/>		<hr/>
	963		1648
5 = $\frac{1}{2}$	160 10	5 = $\frac{1}{2}$	206
	80 5	1 = $\frac{1}{3}$	103
	<hr/>		20 12
	1203 15		<hr/>
	<hr/>		1977 12
			<hr/>

<p><i>s. d.</i> $5\ 0 = \frac{1}{2}$ (80) 146 at 5<i>l.</i> 6<i>s.</i> 6½<i>d.</i> 5 <hr/> 730 1 0 = ½ 96 10 0 6 = ½ 7 6 0 ½ = ½ 3 18 0 ½ = ½ 0 6 1 <hr/> <i>£</i> 777 15 1</p>	<p><i>s. d.</i> $5\ 0 = \frac{1}{2}$ (81) 432 at 6<i>l.</i> 7<i>s.</i> 6<i>d.</i> 6 <hr/> 2592 2 6 = ½ 108 54 <hr/> <i>£</i> 2754</p>
---	---

<p><i>s.</i> $10 = \frac{1}{2}$ (82) 96 at 7<i>l.</i> 15<i>s.</i> 7 <hr/> 672 5 = ½ 48 24 <hr/> 744</p>	<p><i>s. d.</i> $10\ 0 = \frac{1}{2}$ (83) 100 at 8<i>l.</i> 16<i>s.</i> 4<i>d.</i> 8 <hr/> 800 5 0 = ½ 50 1 0 = ½ 25 0 4 = ½ 5 1 13 4 <hr/> 881 13 4</p>
---	---

<p><i>s. d.</i> $10\ 0 = \frac{1}{2}$ (84) 220 at 12<i>l.</i> 10<i>s.</i> 12 <hr/> 2640 110 <hr/> 2750</p>	<p><i>s.</i> $10 = \frac{1}{2}$ (85) 421 at 17<i>l.</i> 13<i>s.</i> 17 <hr/> 7157 2 = ½ 210 10 1 = ½ 42 2 21 1 <hr/> 7430 13</p>
---	---

PRACTICE.

59

s. d.	(86)
10 0 = $\frac{1}{2}$	48 at 18l. 19s.
	18
	<hr/>
	864
5 0 = $\frac{1}{2}$	24
2 6 = $\frac{1}{2}$	12
1 3 = $\frac{1}{2}$	6
0 3 = $\frac{1}{2}$	3
	0 12
	<hr/>
£	909 12
	<hr/>

RULE V.

Example (87) is worked.

(88)
222 at 4s.
2

£ 44 8

(89)
683 at 6s.
3

£ 204 18

(90)
482 at 8s.
4

192 16

(91)
422 at 10s.
5

211 0

(92)
683 at 12s.
6

409 16

(93)
684 at 14s.
7

478 16

$$\begin{array}{r}
 \text{(94)} \\
 322 \text{ at } 16s. \\
 8 \\
 \hline
 \text{£ } 257 \text{ } 12 \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 \text{(95)} \\
 344 \text{ at } 18s. \\
 9 \\
 \hline
 \text{£ } 309 \text{ } 12 \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 \text{(96)} \\
 242 \text{ at } 34s. \\
 17 \\
 \hline
 411 \text{ } 8 \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 \text{(97)} \\
 364 \text{ at } 56s. \\
 28 \\
 \hline
 291 \text{ } 4 \\
 728 \\
 \hline
 1019 \text{ } 4 \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 \text{(98)} \\
 482 \text{ at } 80s. \\
 40 \\
 \hline
 1928 \text{ } 0 \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 \text{(99)} \\
 \frac{1}{2})365 \text{ at } 11s. \\
 5\frac{1}{2} \\
 \hline
 182 \text{ } 10 \\
 18 \text{ } 5 \\
 \hline
 200 \text{ } 15 \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 \text{(100)} \\
 \frac{1}{2})246 \text{ at } 17s. \\
 8\frac{1}{2} \\
 \hline
 196 \text{ } 16 \\
 12 \text{ } 6 \\
 \hline
 209 \text{ } 2 \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 \text{(101)} \\
 \frac{1}{2})690 \text{ at } 6s. \text{ } 8d. \\
 3\frac{1}{2} = 3s. \text{ } 4d. \\
 \hline
 207 \text{ } 0 \\
 23 \text{ } 0 \\
 \hline
 230 \text{ } 0 \\
 \hline
 \end{array}$$

This Rule is universally good for multiplying half any number of shillings, and also pence, into the given quantity. The double of the right-hand figure and overplus fraction (if any) of that product will be shillings, and the rest of the figures pounds, for the answer.

RULE VI.

(102)

grs. lb.	£	s.	
1 0 = $\frac{1}{4}$	1	5	
		4	
	<hr/>		
	5	0	
	0	6	3
	<hr/>		
£	5	6	3
	<hr/>		

Or thus.

gr.	£	s.
1 = $\frac{1}{4}$	1	5
	<hr/>	
	0	6 3
	<hr/>	
s.	cut.	
5 = $\frac{1}{4}$	4	
	1	
	0	6 3
	<hr/>	
£	5	6 3
	<hr/>	

(103)

grs. lb.	£	s.	a.
2 0 = $\frac{1}{2}$	2	6	4
			3
	<hr/>		
	6	19	0
0 14 = $\frac{1}{2}$	1	3	2
	0	5	9 $\frac{1}{2}$
	<hr/>		
£	8	7	11 $\frac{1}{2}$
	<hr/>		

(104)

grs. lb.	£	s.
2 0 = $\frac{1}{2}$	6	16
	$6 \times 12 = 72$	
	<hr/>	
	40	16
		12
	<hr/>	
	489	12
1 0 = $\frac{1}{2}$	3	8
0 14 = $\frac{1}{2}$	1	14
0 7 = $\frac{1}{2}$	0	17
	0	8 6
	<hr/>	
£	495	19 6
	<hr/>	

$$\begin{array}{r|l}
 d. & (47) \\
 6 = \frac{1}{2} & 644 \text{ at } 9\frac{3}{4}d. \\
 \hline
 3 = \frac{1}{2} & 322 \\
 \frac{1}{4} = \frac{1}{4} & 161 \\
 & 40 \quad 3 \\
 \hline
 2|0 & 52|3 \quad 3 \\
 \hline
 \mathcal{L} & 26 \quad 3 \quad 3 \\
 \hline
 \end{array}$$

$$\begin{array}{r|l}
 d. & (48) \\
 6 = \frac{1}{2} & 596 \text{ at } 10d. \\
 \hline
 3 = \frac{1}{2} & 298 \\
 1 = \frac{1}{3} & 149 \\
 & 49 \quad 8 \\
 \hline
 2|0 & 49|6 \quad 8 \\
 \hline
 \mathcal{L} & 24 \quad 16 \quad 8 \\
 \hline
 \end{array}$$

$$\begin{array}{r|l}
 d. & (49) \\
 6 = \frac{1}{2} & 742 \text{ at } 10\frac{1}{4}d. \\
 \hline
 3 = \frac{1}{2} & 371 \\
 1 = \frac{1}{3} & 185 \quad 6 \\
 \frac{1}{4} = \frac{1}{4} & 61 \quad 10 \\
 & 15 \quad 5\frac{1}{2} \\
 \hline
 2|0 & 63|3 \quad 9\frac{1}{2} \\
 \hline
 & 31 \quad 13 \quad 9\frac{1}{2} \\
 \hline
 \end{array}$$

$$\begin{array}{r|l}
 d. & (50) \\
 6 = \frac{1}{2} & 412 \text{ at } 10\frac{1}{2}d. \\
 \hline
 3 = \frac{1}{2} & 206 \\
 1 = \frac{1}{3} & 103 \\
 \frac{1}{2} = \frac{1}{2} & 34 \quad 4 \\
 & 17 \quad 2 \\
 \hline
 2|0 & 36|0 \quad 6 \\
 \hline
 & 18 \quad 0 \quad 6 \\
 \hline
 \end{array}$$

$$\begin{array}{r|l}
 d. & (51) \\
 6 = \frac{1}{2} & 680 \text{ at } 10\frac{3}{4}d. \\
 \hline
 3 = \frac{1}{2} & 340 \\
 1 = \frac{1}{3} & 170 \\
 \frac{1}{2} = \frac{1}{2} & 56 \quad 8 \\
 \frac{1}{4} = \frac{1}{4} & 28 \quad 4 \\
 & 14 \quad 2 \\
 \hline
 2|0 & 60|9 \quad 2 \\
 \hline
 & 30 \quad 9 \quad 2 \\
 \hline
 \end{array}$$

$$\begin{array}{r|l}
 d. & (52) \\
 6 = \frac{1}{2} & 1234 \text{ at } 11d. \\
 \hline
 3 = \frac{1}{2} & 617 \\
 1\frac{1}{2} = \frac{1}{2} & 308 \quad 6 \\
 \frac{1}{2} = \frac{1}{3} & 154 \quad 3 \\
 & 51 \quad 5 \\
 \hline
 2|0 & 113|1 \quad 2 \\
 \hline
 & 56 \quad 11 \quad 2 \\
 \hline
 \end{array}$$

PRACTICE.

58.

$$\begin{array}{r|l}
 \text{d.} & (53) \\
 6 = \frac{1}{2} & 3620 \text{ at } 11\frac{1}{4}d. \\
 \hline
 3 = \frac{1}{2} & 1810 \\
 1\frac{1}{2} = \frac{1}{2} & 905 \\
 \frac{3}{4} = \frac{1}{2} & 452 \quad 6 \\
 & 226 \quad 3 \\
 \hline
 2|0 & 339 \quad 3 \quad 9 \\
 \hline
 \text{£} & 169 \quad 13 \quad 9
 \end{array}$$

$$\begin{array}{r|l}
 \text{d.} & (54) \\
 6 = \frac{1}{2} & 684 \text{ at } 11\frac{1}{2}d. \\
 \hline
 3 = \frac{1}{2} & 342 \\
 1\frac{1}{2} = \frac{1}{2} & 171 \\
 \frac{3}{4} = \frac{1}{2} & 85 \quad 6 \\
 \frac{1}{4} = \frac{1}{2} & 42 \quad 9 \\
 & 14 \quad 3 \\
 \hline
 2|0 & 65 \quad 5 \quad 6 \\
 \hline
 \text{£} & 32 \quad 15 \quad 6
 \end{array}$$

$$\begin{array}{r|l}
 & (55) \\
 & 962 \text{ at } 11\frac{1}{4}d. \\
 \hline
 \text{d.} & 8 = \frac{1}{3} \quad 96 \text{ 4s. the price } 2s.* \\
 \hline
 2 = \frac{1}{3} & 32 \quad 1 \quad 4 \\
 1 = \frac{1}{3} & 8 \quad 0 \quad 4 \\
 \frac{1}{2} = \frac{1}{3} & 4 \quad 0 \quad 2 \\
 \frac{1}{4} = \frac{1}{3} & 2 \quad 0 \quad 1 \\
 & 1 \quad 0 \quad 0\frac{1}{2} \\
 \hline
 \text{£} & 47 \quad 1 \quad 11\frac{1}{2}
 \end{array}$$

* In some cases, it will be more convenient (to find the answer at 2s. as in note page 61, and divide that sum by its aliquot parts

RULE III.

Example (56) is worked.

$$\begin{array}{r|l}
 d. & (57) \\
 4 = \frac{1}{4} & 1241 \text{ at } 2s. 5d. \\
 & \underline{2} \\
 & 2482 \\
 1 = \frac{1}{4} & 413 \quad 8 \\
 & \underline{103 \quad 5} \\
 2|0 & 299|9 \quad 1 \\
 \mathcal{L} & \underline{149 \quad 19 \quad 1}
 \end{array}$$

$$\begin{array}{r|l}
 d. & (58) \\
 6 = \frac{1}{2} & 486 \text{ at } 3s. 8d. \\
 & \underline{3} \\
 & 1458 \\
 2 = \frac{1}{2} & 243 \\
 & \underline{81} \\
 2|0 & 178|2 \\
 \mathcal{L} & \underline{89 \quad 2 \quad 0}
 \end{array}$$

$$\begin{array}{r|l}
 d. & (59) \\
 3 = \frac{1}{3} & 642 \text{ at } 4s. 3d. \\
 & \underline{4} \\
 & 2568 \\
 & \underline{160 \quad 6} \\
 2|0 & 272|8 \quad 6 \\
 & \underline{136 \quad 8 \quad 6}
 \end{array}$$

$$\begin{array}{r|l}
 d. & (60) \\
 6 = \frac{1}{2} & 543 \text{ at } 5s. 11d. \\
 & \underline{5} \\
 & 2715 \\
 3 = \frac{1}{2} & 271 \quad 6 \\
 1\frac{1}{2} = \frac{1}{2} & 135 \quad 9 \\
 \frac{1}{2} = \frac{1}{2} & 67 \quad 10\frac{1}{2} \\
 & \underline{22 \quad 7\frac{1}{2}} \\
 2|0 & 321|2 \quad 9 \\
 & \underline{160 \quad 12 \quad 9}
 \end{array}$$

$$\begin{array}{r|l}
 d. & (61) \\
 6 = \frac{1}{2} & 48 \text{ at } 6s. 10\frac{1}{2}d. \\
 & \underline{6} \\
 & 288 \\
 3 = \frac{1}{2} & 24 \\
 1 = \frac{1}{2} & 12 \\
 \frac{1}{2} = \frac{1}{2} & 4 \\
 & \underline{2} \\
 2|0 & 33|0 \\
 \mathcal{L} & \underline{16 \ 10 \ 0}
 \end{array}$$

$$\begin{array}{r|l}
 d. & (62) \\
 6 = \frac{1}{2} & 412 \text{ at } 7s. 7d. \\
 & \underline{7} \\
 & 2884 \\
 1 = \frac{1}{2} & 206 \\
 & 34 \ 4 \\
 2|0 & 312|4 \ 4 \\
 \mathcal{L} & \underline{156 \ 4 \ 4}
 \end{array}$$

$$\begin{array}{r|l}
 d. \frac{1}{2} & (63) \\
 3 = \frac{1}{2} & 141 \text{ at } 8s. 3\frac{1}{2}d. \\
 & \underline{8} \\
 & 1128 \\
 \frac{1}{4} = \frac{1}{2} & 35 \ 3 \\
 & 2 \ 11\frac{1}{2} \\
 2|0 & 116|6 \ 2\frac{1}{2} \\
 & \underline{58 \ 6 \ 2\frac{1}{2}}
 \end{array}$$

$$\begin{array}{r|l}
 d. & (64) \\
 6 = \frac{1}{2} & 364 \text{ at } 9s. 7\frac{1}{2}d. \\
 & \underline{9} \\
 & 3276 \\
 1 = \frac{1}{2} & 182 \\
 \frac{1}{2} = \frac{1}{2} & 30 \ 4 \\
 & 15 \ 2 \\
 2|0 & 350|3 \ 6 \\
 & \underline{175 \ 3 \ 6}
 \end{array}$$

$$\begin{array}{r|l}
 d. & (65) \\
 4 = \frac{1}{2} & 891 \text{ at } 10s. 5\frac{1}{2}d. \\
 & \underline{10} \\
 & 8910 \\
 1 = \frac{1}{2} & 297 \\
 \frac{1}{4} = \frac{1}{2} & 74 \ 3 \\
 & 18 \ 6\frac{3}{4} \\
 2|0 & 929|9 \ 9\frac{3}{4} \\
 & \underline{464 \ 19 \ 9\frac{3}{4}}
 \end{array}$$

$$\begin{array}{r|l}
 d. & (66) \\
 6 = \frac{1}{2} & 401 \text{ at } 11s. 9\frac{1}{2}d. \\
 & \underline{11} \\
 & 4411 \\
 3 = \frac{1}{2} & 200 \ 6 \\
 \frac{1}{2} = \frac{1}{2} & 100 \ 3 \\
 & 16 \ 8\frac{1}{2} \\
 2|0 & 472|8 \ 5\frac{1}{2} \\
 & \underline{236 \ 8 \ 5\frac{1}{2}}
 \end{array}$$

$d.$ $6 = \frac{1}{2}$	(67) $481 \text{ at } 12s. 8d.$ <hr/> 12 <hr/> 5772 $2 = \frac{1}{3}$	$d.$ $6 = \frac{1}{2}$	(68) $801 \text{ at } 13s. 6d.$ <hr/> 13 <hr/> 10413 $400 \quad 6$ <hr/> $2 0$
	$240 \quad 6$ $80 \quad 2$ <hr/> $2 0$		$1081 3 \quad 6$ <hr/> \pounds
	$609 2 \quad 8$ <hr/> \pounds		$540 \quad 13 \quad 6$ <hr/>
	$304 \quad 12 \quad 8$ <hr/>		

$d.$ $6 = \frac{1}{2}$	(69) $482 \text{ at } 14s. 8d.$ <hr/> 14 <hr/> 6748 $2 = \frac{1}{3}$	$d.$ $6 = \frac{1}{2}$	(70) $321 \text{ at } 15s. 9d.$ <hr/> 15 <hr/> 4815 $3 = \frac{1}{3}$
	241 $80 \quad 4$ <hr/> $2 0$		$160 \quad 6$ $80 \quad 3$ <hr/> $2 0$
	$706 9 \quad 4$ <hr/> $353 \quad 9 \quad 4$ <hr/>		$505 5 \quad 9$ <hr/> $252 \quad 15 \quad 9$ <hr/>

$d.$ $6 = \frac{1}{2}$	(71) $218 \text{ at } 16s. 10d.$ <hr/> 16 <hr/> 3488 $3 = \frac{1}{3}$	$d.$ $4 = \frac{1}{2}$	(72) $466 \text{ at } 17s. 4d.$ <hr/> 17 <hr/> 7922 $1 = \frac{1}{3}$
	109 $54 \quad 6$ $18 \quad 2$ <hr/> $2 0$		$155 \quad 4$ <hr/> $2 0$
	$366 9 \quad 8$ <hr/> $183 \quad 9 \quad 8$ <hr/>		$807 7 \quad 4$ <hr/> $403 \quad 17 \quad 4$ <hr/>

PRACTICE.

67

(3)					(4)				
<i>I.</i>	<i>F.</i>	<i>I.</i>	<i>F.</i>	<i>I.</i>	<i>I.</i>	<i>F.</i>	<i>I.</i>	<i>F.</i>	<i>I.</i>
$4 = \frac{1}{4}$	12	6	by 8	5	$6 = \frac{1}{2}$	26	4	by 12	7
		8					12		
	<hr/>					<hr/>			
	100	0				316	0		
$1 = \frac{1}{4}$	4	2			$1 = \frac{1}{8}$	13	2		
	1	0	6			2	2	4	
	<hr/>					<hr/>			
	105	2	6			331	4	4	
	<hr/>					<hr/>			

(5)					(6)				
<i>I.</i>	<i>F.</i>	<i>I.</i>	<i>F.</i>	<i>I.</i>	<i>I.</i>	<i>F.</i>	<i>I.</i>	<i>F.</i>	<i>I.</i>
$2 = \frac{1}{2}$	76	6	by 48	3	$6 = \frac{1}{2}$	38	7	by 45	6
			$6 \times 8 = 48.$				$9 \times 5 = 45.$		
	<hr/>					<hr/>			
	459	0				347	3		
		8					5		
	<hr/>					<hr/>			
	3672	0				1736	3		
	19	1	6			19	3	6	
	<hr/>					<hr/>			
	3691	1	6			1755	6	6	
	<hr/>					<hr/>			

(7)					(8)				
<i>I.</i>	<i>F.</i>	<i>I.</i>	<i>F.</i>	<i>I.</i>	<i>I.</i>	<i>F.</i>	<i>I.</i>	<i>F.</i>	<i>I.</i>
$2 = \frac{1}{2}$	79	2	by 84	2	$3 = \frac{1}{2}$	126	6	by 121	3
			$12 \times 7 = 84.$				$11 \times 11 = 121.$		
	<hr/>					<hr/>			
	950	0				1391	6		
		7					11		
	<hr/>					<hr/>			
	6650	0				15306	6		
	13	2	4			31	7	6	
	<hr/>					<hr/>			
	6663	2	4			15338	1	6	
	<hr/>					<hr/>			

<p>s. d. 5 0 = $\frac{1}{2}$</p> <p>1 0 = $\frac{1}{2}$</p> <p>0 6 = $\frac{1}{2}$</p> <p>0 $\frac{1}{2}$ = $\frac{1}{2}$</p>	<p>(80) 146 at 5l. 6s. 6$\frac{1}{2}$d. 5</p> <hr/> <p>730</p> <p>96 10</p> <p>7 6</p> <p>3 18</p> <p>0 6 1</p> <hr/> <p>£ 777 15 1</p>	<p>s. d. 5 0 = $\frac{1}{2}$</p> <p>2 6 = $\frac{1}{2}$</p>	<p>(81) 432 at 6l. 7s. 6d. 6</p> <hr/> <p>2592</p> <p>108</p> <p>54</p> <hr/> <p>£ 2754</p>
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<p>s. 10 = $\frac{1}{2}$</p> <p>5 = $\frac{1}{2}$</p>	<p>(82) 96 at 7l. 15s. 7</p> <hr/> <p>672</p> <p>48</p> <p>24</p> <hr/> <p>744</p>	<p>s. d. 10 0 = $\frac{1}{2}$</p> <p>5 0 = $\frac{1}{2}$</p> <p>1 0 = $\frac{1}{2}$</p> <p>0 4 = $\frac{1}{2}$</p>	<p>(83) 100 at 8l. 16s. 4d. 8</p> <hr/> <p>800</p> <p>50</p> <p>25</p> <p>5</p> <p>1 13 4</p> <hr/> <p>881 13 4</p>
---	--	--	---

<p>s. d. 10 0 = $\frac{1}{2}$</p>	<p>(84) 220 at 12l. 10s. 12</p> <hr/> <p>2640</p> <p>110</p> <hr/> <p>2750</p>	<p>s. 10 = $\frac{1}{2}$</p> <p>2 = $\frac{1}{2}$</p> <p>1 = $\frac{1}{2}$</p>	<p>(85) 421 at 17l. 13s. 17</p> <hr/> <p>7157</p> <p>210 10</p> <p>42 2</p> <p>21 1</p> <hr/> <p>7430 13</p>
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PRACTICE.

59

s. d.	(86)
10 0 = $\frac{1}{2}$	48 at 18l. 19s.
	18
	<hr/>
	864
5 0 = $\frac{1}{3}$	24
2 6 = $\frac{1}{2}$	12
1 3 = $\frac{1}{2}$	6
0 3 = $\frac{1}{3}$	3
	0 12
	<hr/>
£	909 12
	<hr/>

RULE V.

Example (87) is worked.

(88)
222 at 4s.
2

£ 44 8

(89)
683 at 6s.
3

£ 204 18

(90)
482 at 8s.
4

192 16

(91)
422 at 10s.
5

211 0

(92)
683 at 12s.
6

409 16

(93)
684 at 14s.
7

478 16

PRACTICE.

		(19)			
I. P.		F.	I.	P.	
1 0 = $\frac{1}{12}$		371	2	3	
2 0 = $\frac{1}{6}$		181	1	3	
		<hr/>			
		371			
		2968			
		371			
0 3 = $\frac{1}{4}$		30	11	2	3
		7	8	9	6 9
0 3 = $\frac{1}{8}$		30	2	0	0 0
		3	9	3	0 0
		<hr/>			
		67223	7	2	9 9
		<hr/>			

		(20)			
I. P.		F.	I.	P.	
4 0 = $\frac{1}{3}$		487	10	10	
6 0 = $\frac{1}{2}$		186	5	6	
		<hr/>			
		2922			
		3896			
		487			
1 0 = $\frac{1}{6}$		162	7	7	4
0 6 = $\frac{1}{3}$		40	7	10	10
		20	3	11	5
3 0 = $\frac{1}{2}$		93	0	0	0
1 0 = $\frac{1}{3}$		46	6	0	0
0 6 = $\frac{1}{2}$		15	6	0	0
0 3 = $\frac{1}{3}$		7	9	0	0
0 1 = $\frac{1}{3}$		3	10	6	0
		1	3	6	0
		<hr/>			
		90973	6	5	7
		<hr/>			

PRACTICE.

71

(21)

I.	F. I.	F. I.
$2 = \frac{1}{2}$	18 6 by 1 2	
	3 1	
	<hr/> 21 7	

(22)

I.	F. I.	F. I.
$4 = \frac{1}{2}$	45 6 by 9 4	
	9	
	<hr/> 409 6	
	15 2	
	<hr/> 424 8	

(23)

I.	F. I.	F. I.
$6 = \frac{1}{2}$	47 8 by 64 6	
	$8 \times 8 = 64.$	
	<hr/> 381 4	
	8	
	<hr/> 3050 8	
	23 10	
9	<hr/> 3074 6	
	<hr/> 341 5 6	

(24)

I.	F. I.	F. I.
$6 = \frac{1}{2}$	864 3 by 62 6	
	$6 \times 10 + 2 = 62$	
	<hr/> 5185 6	
	10	
	<hr/> 51855 0	
	1728 6	
	<hr/> 432 1 6	
9	<hr/> 54015 7 6	
	<hr/> 6001 6 7 6	

(25)

F. I.	F. I.
60 9 by 22 3	
$2 \times 11 = 22$	
<hr/> 121 6	
11	
<hr/> 1936 6	
15 2 3	
<hr/> 9)1351 8 3	
<hr/> 150 1 8 3	

(26)

F. I.	F. I.
40 6 by 9 3	
9	
<hr/> 364 6	
10 1 6	
<hr/> 9)374 7 6	
<hr/> 41 5 7 6	

PRACTICE.

(27)

I. P.	F. I. P.	F. I. P.
4 0 = $\frac{1}{3}$	3 8 9	by 1 4 6
0 6 = $\frac{1}{8}$	1 2 11	
	0 1 10	4 6
	<hr/>	
	5 1 6	4 6
	<hr/>	

(28)

I. P.	F. I. P.	F. I. P.
4 0 = $\frac{1}{3}$	3 7 9	by 1 5 1
1 0 = $\frac{1}{4}$	1 2 7	
0 1 = $\frac{1}{12}$	0 3 7 9	
	0 0 3 7 9	
	<hr/>	
	5 2 3 4 9	
		35 × = 15
	<hr/>	
	15 6 10 2 3	
		5
	<hr/>	
	77 10 2 11 3	
	<hr/>	

(29)

I. P.	F. I.	F. I.
3 0 = $\frac{1}{4}$	1 6	breadth by 1 3 depth.
	0 4 6	
	<hr/>	
3 0 = $\frac{1}{4}$	1 10 6	F.
		4 × 4 = 16
	<hr/>	
	7 6 0	
		4
	<hr/>	
	30 0 0	
	0 5 7 6	
	<hr/>	
	30 5 7 6	solid content.
	<hr/>	

TARE AND TRET.

73

		(30)							
<i>I. P.</i>		<i>F.</i>	<i>I.</i>	<i>P.</i>		<i>F.</i>	<i>I.</i>	<i>P.</i>	
20 = $\frac{1}{6}$		1	5	6	breadth by	1	2	10	depth
08 = $\frac{1}{3}$		0	2	11					
02 = $\frac{1}{4}$		0	0	11	8				
		0	0	2	11				
30 = $\frac{1}{4}$		1	9	7	7	<i>I. P.</i>	<i>F.</i>	<i>I.</i>	<i>P.</i>
		12+3 7=12 3 7 length							
		21	7	7	0				
06 = $\frac{1}{6}$		0	5	4	10	9			
01 = $\frac{1}{8}$		0	0	10	9	9	6		
		0	0	1	9	7	7		
		22	2	0	6	2	1	solid content	

TARE AND TRET.

No. (1) is worked.

		(2)			
<i>lb.</i>	<i>c.</i>	<i>gr.</i>	<i>lb.</i>		
	9	2	8		
14			8		
8					
—	76	2	8	gross	
112 =	1	0	0	tare	
Ans.	75	2	8	neat weight	
	76	2	8	proof	

TARE AND TRET.

(3)

lb.		C.		gr.	lb.	
28						
14						
<hr/>						
28	{	4)322	$2 \times 7 = 14$			
		<hr/>				
		7)80 2	11 0 10			
		<hr/>	7			
		4)11 3	14 lb.			
		<hr/>				
			77 2 14 gross			
		Tare 2 3 14	= 2 3 14 tare			
		<hr/>				
			Ans. 74 3 0 neat weight			
			<hr/>			
			77 2 14 proof			
			<hr/>			

(4)

lb.		C.		gr.	lb.	
24						
10						
<hr/>						
Tare	2 0 16				$6 \times 4 = 24$	
					11 0 4	
					4	
					<hr/>	
					44 0 16 gross	
					2 0 16 tare	
					<hr/>	
					Ans. 42 0 0 neat weight	
					<hr/>	
					44 0 16 proof	
					<hr/>	

TARE AND TRET.

75

(5)

lb.	C. gr. lb.
18	1 2 13
$4 \times 5 = 20$	$5 \times 4 = 20$
2 16	8 0 9
5	4
Tare 3 0 24	32 1 8 gross
	3 0 24 tare
	Ans. 29 0 12 neat weight
	32 1 8 proof

CASE II.

(6)

	C. gr. lb.
	4 2 6
	6
$14 = \frac{1}{8}$	27 1 8 gross
	3 1 18 tare
	23 3 18 neat weight

(7)

lb.	C. gr. lb.
$16 = \frac{1}{4}$	127 3 14 gross
	18 1 2 tare
	109 2 12 neat wt.

(8)

	C. gr. lb.
	2 1 5
	$6 \times 6 = 36$
	13 9 2
	6
lb.	82 2 12 gross
$14 = \frac{1}{8}$	10 1 8 $\frac{1}{2}$ } subtract
$7 = \frac{1}{2}$	5 0 18 $\frac{1}{4}$ }
	5 0 18 $\frac{1}{4}$ tare
	77 1 21 $\frac{1}{4}$ neat wt.

	(9)		
	C.	qr.	lb.
	7	0	0
			3
lb.			
$14 = \frac{1}{8}$	21	0	0 gross
$7 = \frac{1}{2}$	2	2	14
$3\frac{1}{2} = \frac{1}{2}$	1	1	7
	0	2	$17\frac{1}{2}$
	1	3	$24\frac{1}{2}$ tare
	19	0	$3\frac{1}{2}$ neat wt.

	(10)		
	C.	qr.	lb.
	5	2	4
			$4 \times 4 = 16$.
	22	0	16
			4
lb.			
$14 = \frac{1}{8}$	88	2	8 gross
$7 = \frac{1}{2}$	11	0	8
	5	2	4
	16	2	12 tare
	71	3	$24\frac{1}{2}$ neat wt.

CASE III.

	(11)		
	C.	qr.	lb.
lb.	20	1	4 gross
$7 = \frac{1}{4}$	5	0	8
	1	1	2
	6	1	10 tare
* 26	13	3	22 suttle
	0	2	$4\frac{1}{3}$ tret
	13	1	$17\frac{2}{3}$ neat wt.

* $104 + 4 = 26$.

	(12)		
	C.	qr.	lb.
lb.	6	2	24 gross
	0	3	10 tare
26	5	3	14 suttle
	0	0	$25\frac{1}{3}$ tret
	5	2	$16\frac{2}{3}$ neat wt.

TARE AND TRET.

77

(13)			(14)		
	C.	gr. lb.		C.	gr. lb.
	9	1 14		4	2 7
		12			8
lb.			lb.		
$14 = \frac{1}{8}$	112	2 0 gross	$16 = \frac{1}{7}$	36	2 0 gross
$7 = \frac{1}{2}$	14	0 7	$8 = \frac{1}{2}$	5	0 24
	7	0 $3\frac{1}{2}$		2	2 12
	21	0 $10\frac{1}{2}$ tare		7	3 8 tare
6	91	1 $17\frac{1}{2}$ suttie	26	28	2 20 suttie
	3	2 $1\frac{1}{4}$ tret		1	0 $11\frac{1}{13}$ tret
	87	3 $15\frac{3}{4}$ neat wt.		27	2 $8\frac{6}{13}$ neat wt.

(15)		
	C.	gr. lb.
	2	3 14
		$4 \times 7 = 28.$
	11	2 0
		7
$14 = \frac{1}{8}$	80	2 0 gross
$7 = \frac{1}{2}$	10	0 7
$3\frac{1}{2} = \frac{1}{2}$	5	0 $3\frac{1}{2}$
	2	2 $1\frac{1}{4}$
	17	2 $12\frac{1}{4}$ tare
26	62	3 $15\frac{3}{4}$ suttie
	2	1 $18\frac{3}{4}$ $1\frac{1}{6}$ tret
	60	1 $24\frac{1}{4}$ $\frac{9}{16}$ neat weight.

CASE IV.

(16)		(17)	
lb.	C. gr. lb.	lb.	C. gr. lb. oz.
14= $\frac{1}{8}$	32 3 12 gross	16= $\frac{1}{4}$	64 3 0 0 gross
	4 0 12 tare	8= $\frac{1}{2}$	9 1 0 0
26	28 3 0uttle 1 0 11 13 tret	26	4 2 14 0 tare
*168	27 2 16 3 tretuttle 0 0 18 6 cloff	168	60 0 14 0uttle 2 1 7 0 tret
	27 1 25 13 neat wt.		57 3 7 0 tretuttle 0 1 10 8 $\frac{1}{2}$ cloff
			57 1 24 7 $\frac{1}{2}$ neat wt.

(18)		(19)	
lb.	C. gr. lb.		C. gr. lb.
	12 1 16		9 1 14
	6 \times 6 = 36		6
	74 1 12		56 1 0 gross
	6		5 1 24 tare
14= $\frac{1}{8}$	446 0 16 gross	26	50 3 4 0uttle 1 3 22 12 tret
7= $\frac{1}{2}$	55 3 2	168	48 3 9 4 tretuttle 0 1 4 8 cloff
	27 3 15		48 2 4 12 neat wt.
	83 2 17 tare		
26	362 1 27uttle 13 3 21 $\frac{1}{2}$ tret		
168	348 2 5 $\frac{1}{2}$ tretuttle 2 0 8 $\frac{1}{4}$ 1 $\frac{1}{8}$ cloff		
	346 1 25 1 $\frac{1}{8}$ neat wt.		

* 2 lb. is the 168th part of 3 cwt. or 336 lb.

SIMPLE INTEREST.

79

(20)			
lb.	c.	gr.	dw.
16 = $\frac{1}{7}$	28	2	0 gross
2 = $\frac{1}{8}$	4	0	8
	0	2	1
	4	2	9 tare
26	23	3	19 $\frac{1}{2}$ uttle
	0	3	19 tret
168	23	0	0 $\frac{1}{2}$ tretuttle
	0	0	15 $\frac{1}{3}$ cloff
	22	3	12 $\frac{1}{2}$ neat wt.

SIMPLE INTEREST.

£
364
5
18,20 18 $\frac{1}{2}$ 4s. Ans.
20
4,00

NOTE. When the rate per cent is an aliquot part, the operation is better performed by Practice, thus in Ex. (1)

$$5 = \frac{1}{20} \text{ } 364 \text{ at } 5 \text{ per cent.}$$

£ 18 4 the interest required.

$$(2) \quad \frac{364 \times 4\frac{1}{2}}{100} = 16\text{ } 7\text{s. } 7\frac{1}{2}\text{d.}$$

E 4

SIMPLE INTEREST.

$$(3) \quad \frac{364 \times 4}{100} = 14\text{l. } 11\text{s. } 2\frac{1}{4}\text{d}$$

$$(4) \quad \begin{array}{r} \text{£} \quad \text{s.} \quad \text{d.} \\ 5 = \frac{1}{20}) 500 \quad 10 \quad 6\frac{1}{4} \\ \hline \text{£} \quad 25 \quad 0 \quad 6\frac{1}{4} \quad \frac{1}{4} \end{array}$$

$$(5) \quad \begin{array}{r} \text{£.} \quad \text{s.} \quad \text{d.} \\ 862 \quad 16 \quad 8 \times 4\frac{1}{2} \\ \hline 100 \end{array} = 38\text{l. } 16\text{s. } 6\frac{1}{2}\frac{1}{2}\text{d.}$$

$$(6) \quad \begin{array}{r} \text{£} \quad \text{s.} \quad \text{d.} \\ 4 = \frac{1}{25}) 1000 \quad 16 \quad 8 \\ \hline \text{£} \quad 40 \quad 0 \quad 8 \end{array}$$

(7) First, $5 \times 5 = 25$ product of the rate and time;
 then, $\begin{array}{r} \text{£} \\ 25 = \frac{1}{4}) 486 \\ \hline \text{£} \quad 121 \quad 10 \end{array}$

$$(8) \quad \begin{array}{r} \text{£} \\ 5 = \frac{1}{20}) 884 \\ \hline 44 \quad 4 \text{ interest for 1 year} \\ 7 \\ \hline 309 \quad 8 \text{ do. for 7 years} \\ 884 \quad 0 \text{ principal} \\ \hline \text{£} \quad 1193 \quad 8 \text{ the amount.} \end{array}$$

$$(9) \quad \begin{array}{r} 1001 \times 4\frac{1}{2} \times 6 \\ \hline 100 \end{array} = \begin{array}{r} \text{£} \quad \text{s.} \quad \text{d.} \\ 270 \quad 5 \quad 4\frac{1}{2} \text{ interest} \\ 1001 \quad 0 \quad 0 \text{ principal} \\ \hline \text{£} \quad 1271 \quad 5 \quad 4\frac{1}{2} \text{ amount} \end{array}$$

SIMPLE INTEREST.

81

(10) $\frac{460 \times 3\frac{1}{2}}{100} = 17 \frac{5}{4}$ interest for 1 year

69 0 do. for 4 years
 460 0 principal

£ 529 0 amount.

(11) $\frac{£}{5} = \frac{1}{20} \mid \frac{£}{924}$

mo. $2 = \frac{1}{6} \mid 46 \frac{4}{6}$ interest for 1 year

£ 7 14 interest for 2 months.

(12) $\frac{£}{4} = \frac{1}{35} \mid \frac{£}{1205}$

mo. $6 = \frac{1}{2} \mid 48 \frac{4}{2}$ interest for 1 year.

£ 24 2 interest for $\frac{1}{2}$ year.

(13) $\frac{£}{5} = \frac{1}{20} \mid \frac{£}{640} \frac{s.}{8} \frac{d.}{4}$

32 0 5 interest for 1 year

224 2 11 interest for 7 years
 640 8 4 principal

£ 864 11 3 amount.

(14)

	£	s.	d.	
$5 = \frac{1}{20}$	9640	16	8	
mo. $6 = \frac{1}{2}$	482	0	10	interest for 1 year
			4	
	1928	3	4	interest for 4 years
$8 = \frac{1}{2}$	241	0	5	interest for 6 months
	120	10	2½	interest for 3 months
	2289	13	11½	interest for 4 yrs. 9 mo.
	9640	16	8	principal
	£ 11930	10	7½	amount.

(15)

	£	s.	
$5 = \frac{1}{20}$	20	0	
wks. $13 = \frac{1}{4}$	1	0	interest for 1 year
	0	5	interest for 13 weeks
	20	0	principal
	£ 20	5	amount.

(16)

	£	
$5 = \frac{1}{20}$	500	
	£ 25	interest for 1 year;

then, 52 wks. : 25l. :: 39 wks. : 18l. 15s.

	£	s.	
and $25 \times 4 = 100$	0		interest for 4 years
	18	15	interest for 39 weeks
	500	0	principal
	£ 618	15	amount.

$$(17) \quad \begin{array}{r} \pounds \\ 5 = \frac{1}{20} \mid 641 \\ \hline \pounds 32 \quad 1 \text{ interest for 1 year;} \end{array}$$

then, 365 days : 32*l.* 1*s.* :: 50 days : 4*l.* 7*s.* 9½*d.*

$$(18) \quad \begin{array}{r} \pounds \\ 2000 \times 4\frac{1}{2} \\ \hline 100 = 90\text{ } \text{ interest for 1 year;} \end{array}$$

then, 365 days : 90*l.* :: 63 days : 15*l.* 10*s.* 8½*d.*

$$(19) \quad \begin{array}{r} \pounds \quad \pounds \quad \textit{s.} \quad \textit{d.} \\ 4 = \frac{1}{25} \mid 5800 \quad 16 \quad 8 \\ \hline \pounds 232 \quad 0 \quad 3 \text{ interest for 1 year;} \end{array}$$

then, 365 days : 232*l.* 0*s.* 3*d.* :: 260 days : 165*l.* 5*s.* 8½*d.* interest; and, 5800*l.* 16*s.* 8*d.* + 165*l.* 5*s.* 8½*d.* = 5966*l.* 2*s.* 4½*d.* amount.

$$(20) \quad \begin{array}{r} \pounds \quad \pounds \quad \textit{s.} \quad \textit{d.} \\ 5 = \frac{1}{20} \mid 563 \quad 12 \quad 6\frac{1}{2} \\ \hline \pounds 28 \quad 3 \quad 7\frac{1}{2} \frac{1}{10} \text{ interest for 1 year;} \end{array}$$

then, 365 days : 28*l.* 3*s.* 7½*d.* 10*d.* :: 265 days : 20*l.* 9*s.* 2½*d.*

COMMISSION.

$$(1) \quad \begin{array}{r} \pounds \\ 2\frac{1}{2} = \frac{1}{40} \mid 500 \\ \hline \pounds 12 \quad 10 \end{array}$$

$$(2) \quad \begin{array}{r} 2 = \frac{1}{50} \mid 369 \\ \hline \pounds 7 \quad 7 \quad 7\frac{1}{2} \end{array}$$

BROKAGE.

$$(3) \quad \begin{array}{r} \text{£} \quad \text{s.} \quad \text{d.} \\ 748 \quad 11 \quad 8 \times 3 \\ \hline 100 \end{array} = 22\text{l. } 9\text{s. } 1\frac{1}{4}\frac{1}{2}\text{d.}$$

$$(4) \quad \frac{1900 \times 5\frac{1}{2}}{100} = 111\text{l. } 12\text{s. } 6\text{d.}$$

BROKAGE.

$$(1) \quad \begin{array}{r} \text{£} \\ 100 \mid 640 \\ \text{s.} \quad \text{£} \\ 5 = \frac{1}{4} \mid \quad 6 \quad 8 \text{ at 1 per cent.} \\ \hline \text{£} \quad 1 \quad 12 \text{ at 5s. per cent.} \\ \hline \end{array}$$

$$(2) \quad \begin{array}{r} \text{£} \\ 100 \mid 845 \\ \text{s.} \quad \text{£} \\ 10 = \frac{1}{2} \mid \quad 8 \quad 9 \text{ at 1 per cent.} \\ \hline \text{£} \quad 4 \quad 4 \quad 6 \text{ at 10s. per cent.} \\ \hline \end{array}$$

$$(3) \quad 2\frac{1}{2} = \frac{1}{40} \mid \begin{array}{r} \text{£} \quad \text{s.} \quad \text{d.} \\ 202 \quad 1 \quad 8 \\ \hline 5 \quad 1 \quad 0\frac{1}{2} \\ \hline \end{array}$$

$$(4) \quad \begin{array}{r} \text{£} \quad \text{s.} \quad \text{d.} \\ 4360 \quad 8 \quad 4 \times 3 \\ \hline 100 \end{array} = 130\text{l. } 16\text{s. } 3\text{d.}$$

$$(5) \quad \frac{240 \quad 16 \quad 8 \times 3\frac{1}{4}}{100} = 7\text{l. } 16\text{s. } 6\frac{1}{2}\text{d.}$$

INSURANCE

$$\begin{array}{rcl}
 \text{(1)} & \begin{array}{l} \text{£} \\ 10 = \frac{1}{10} \end{array} & \left| \begin{array}{l} \text{£} \\ 4680 \end{array} \right. \\
 & \begin{array}{l} \frac{1}{2} = \frac{1}{20} \\ \frac{1}{4} = \frac{1}{40} \end{array} & \left| \begin{array}{l} 468 \\ 23 \quad 8 \end{array} \right. \\
 & & \hline
 & & \text{£ } 491 \quad 8
 \end{array}$$

$$\begin{array}{rcl}
 \text{(2)} & 10 = \frac{1}{10} & \left| \begin{array}{l} 9000 \\ 900 \\ 45 \\ 22 \quad 10 \end{array} \right. \\
 & \frac{1}{2} = \frac{1}{20} & \\
 & \frac{1}{4} = \frac{1}{40} & \\
 & & \hline
 & & 967 \quad 10
 \end{array}$$

$$\begin{array}{rcl}
 \text{(3)} & \begin{array}{l} \text{£} \\ 10 = \frac{1}{10} \end{array} & \left| \begin{array}{l} \text{£} \quad \text{s.} \\ 782 \quad 10 \end{array} \right. \\
 & \begin{array}{l} 5 = \frac{1}{2} \\ \frac{1}{2} = \frac{1}{10} \end{array} & \left| \begin{array}{l} 78 \quad 5 \\ 39 \quad 2 \quad 6 \\ 3 \quad 18 \quad 3 \end{array} \right. \\
 & & \hline
 & & \text{£ } 121 \quad 5 \quad 9
 \end{array}$$

$$\text{(4)} \quad \frac{780 \times 5\frac{1}{2}}{100} = 41\text{l. } 18\text{s. } 6\text{d.}$$

$$\text{(5)} \quad \frac{1500 \times 6\frac{1}{2}}{100} = 97\text{l. } 10\text{s.}$$

DISCOUNT.

PURCHASING STOCKS.

Example (1) is worked.

$$(2) \quad \begin{array}{r|l} \text{£} & \text{£} \quad \text{s.} \quad \text{d.} \\ 20 = \frac{1}{2} & \begin{array}{l} 640 \quad 8 \quad 0 \text{ at 100 per cent.} \\ 128 \quad 1 \quad 7\frac{1}{2} \text{ at 20 per cent.} \end{array} \\ \hline & \text{£} \quad 768 \quad 9 \quad 7\frac{1}{2} \end{array}$$

$$(3) \quad \begin{array}{r|l} \text{£} & \text{£} \quad \text{s.} \quad \text{d.} \\ 20 = \frac{1}{2} & \begin{array}{l} 926 \quad 0 \quad 0 \text{ at 100 per cent.} \\ 185 \quad 4 \quad 0 \text{ at 20 per cent.} \\ \frac{1}{2} = \frac{1}{20} & \begin{array}{l} 92 \quad 12 \quad 0 \text{ at 10 per cent.} \\ 4 \quad 12 \quad 7\frac{1}{2} \text{ at } \frac{1}{2} \text{ per cent.} \end{array} \end{array} \\ \hline & \text{£} \quad 1208 \quad 8 \quad 7\frac{1}{2} \end{array}$$

$$(4) \quad \frac{1752 \times 115\frac{1}{2}}{100} = 2025\text{ } 15\text{s.}$$

$$(5) \quad \frac{1200 \times 84\frac{1}{2}}{100} = 1009\text{ } 10\text{s.}$$

$$(6) \quad \begin{array}{l} \text{First, } 90\frac{1}{8} + \frac{1}{8} = 90\frac{1}{2} \\ 1300 \times 90\frac{1}{2} \\ \text{then, } \frac{\quad}{100} = 1176\text{ } 10\text{s.} \end{array}$$

DISCOUNT.

Example (1) is worked.

$$(2) \quad \begin{array}{r|l} \text{£} & \\ 5 = \frac{1}{20} & 100 \\ \hline & \text{£} \quad 5 \text{ interest of 100 for 12 months,} \\ & \hline \text{then, } 105\text{ } 5\text{ } :: 50\text{ } : 2\text{ } 7\text{s. } 7\frac{1}{2}\text{d. } 75 \text{ remain.} \end{array}$$

DISCOUNT.

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(3) 105*l.* : 100*l.* :: 200*l.* : 190*l.* 9*s.* 6½*d.* 15 remain.

$$(4) \quad \begin{array}{r} \text{mths.} \\ 3 = \frac{1}{4} \end{array} \bigg| \begin{array}{r} \text{£} \\ 5 \end{array}$$

$$\begin{array}{r} 1 \quad 5 \text{ interest} \\ 100 \\ \hline 101 \quad 5 \text{ amount;} \end{array}$$

then, 101*l.* 5*s.* : 1*l.* 5*s.* :: 36*l.* : 35*l.* 11*s.* 1½*d.* 1950 remain.

$$(5) \quad \begin{array}{r} \text{£} \quad \text{s.} \\ 4 \quad 10 \times 3 = \end{array} \begin{array}{r} \text{£} \quad \text{s.} \\ 13 \quad 10 \text{ interest} \\ 100 \quad 0 \text{ principal} \end{array}$$

$$113 \quad 10 \text{ amount;}$$

then, 113*l.* 10*s.* : 13*l.* 10*s.* :: 573*l.* 16*s.* : 68*l.* 4*s.* 11½*d.* 83 remain.

$$(6) \quad \text{First, } 20 \times 4\frac{1}{2} = \begin{array}{r} \text{£} \quad \text{s.} \quad \text{d.} \\ 4 \quad 7 \quad 6 \text{ interest for 1 year} \\ 2 \quad 3 \quad 9 \text{ interest for 6 months} \\ 1 \quad 1 \quad 10\frac{1}{2} \text{ interest for 3 months} \\ 100 \quad 0 \quad 0 \text{ principal} \end{array}$$

$$107 \quad 13 \quad 1\frac{1}{2} \text{ amount;}$$

then, 107*l.* 13*s.* 1½*d.* : 100*l.* :: 130*l.* : 120*l.* 15*s.* 1*d.* 546 remain.

$$(7) \quad \begin{array}{r} \text{days} \\ 73 = \frac{1}{4} \end{array} \bigg| \begin{array}{r} \text{£} \\ 5 \end{array}$$

$$\begin{array}{r} 1 \text{ interest for 73 days} \\ 100 \text{ principal} \\ \hline 101 \text{ amount;} \end{array}$$

then, 101*l.* : 1*l.* :: 399*l.* 13*s.* 4*d.* : 3*l.* 19*s.* 1½ ⁸²/₁₀₁ *d.* discount.
and, 399*l.* 13*s.* 4*d.* - 3*l.* 19*s.* 1½ ⁸²/₁₀₁ *d.* = 395*l.* 14*s.* 2½ ¹²/₁₀₁ *d.* the present worth.

COMPOUND INTEREST.

(1)	$5 = \frac{1}{20}$	\pounds	s.	d.	
		50	0	0	
		2	10	0	1st year's interest
<hr/>					
	$5 = \frac{1}{20}$	52	10	0	amount
		2	12	6	2d year's interest
<hr/>					
	$5 = \frac{1}{20}$	55	2	6	amount
		2	15	$1\frac{1}{2}$	3d year's interest
<hr/>					
		\pounds	57	17	$7\frac{1}{2}$ amount.

(2)	$\frac{1}{20}$	\pounds	s.	d.	
		100	0	0	principal
		5	0	0	1st year's interest
<hr/>					
	$\frac{1}{20}$	105	0	0	2d year's principal
		5	5	0	interest
<hr/>					
	$\frac{1}{20}$	110	5	0	3d year's principal
		5	10	3	interest
<hr/>					
	$\frac{1}{20}$	115	15	3	4th year's principal
		5	15	$9\frac{3}{20}$	interest
<hr/>					
	\pounds	121	11	$0\frac{3}{20}$	amount.

COMPOUND INTEREST.

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(3)

per cent.	£	s.	d.	
5 $\frac{1}{2}$	100	0	0	principal
$\frac{1}{2}$	5	0	0	
	2	10	0	
	100	0	0	
20	102	10	0	the 1st half year's amount
$\frac{1}{2}$	5	2	6	
	2	11	5	
	102	10	0	
20	105	1	3	the 2d half year's amount
$\frac{1}{2}$	5	5	0 $\frac{1}{2}$	
	2	12	0 $\frac{1}{2}$	
	105	1	3	
20	107	13	9 $\frac{1}{2}$	the 3d half year's amount
$\frac{1}{2}$	5	7	8 $\frac{1}{2}$	
	2	13	10	
	107	13	9 $\frac{1}{2}$	
20	110	7	7 $\frac{1}{2}$	the 4th half year's amount
$\frac{1}{2}$	5	10	4 $\frac{1}{2}$	
	2	15	2 $\frac{1}{2}$	
	110	7	7 $\frac{1}{2}$	
20	113	2	9 $\frac{1}{2}$	the 5th half year's amount
$\frac{1}{2}$	5	13	1 $\frac{1}{2}$	
	2	16	6 $\frac{1}{2}$	
	113	2	9 $\frac{1}{2}$	
20	115	19	4 $\frac{1}{2}$	the 6th half year's amount
$\frac{1}{2}$	5	15	11 $\frac{1}{2}$	
	2	17	11 $\frac{1}{2}$	
	115	19	4 $\frac{1}{2}$	
20	118	17	4	the 7th half year's amount
$\frac{1}{2}$	5	18	10 $\frac{1}{2}$	
	2	19	5	
	118	17	4	
£	121	16	9	the 8th half year's amount.

COMPOUND INTEREST.

(4)

\mathcal{L}	\mathcal{L}	s.	d.	
$5 = \frac{1}{20}$	100	0	0	principal
$\frac{1}{4}$	<u>5</u>	<u>0</u>	<u>0</u>	
	1	5	0	
	<u>100</u>	<u>0</u>	<u>0</u>	
$\frac{1}{20}$	101	5	0	the 1st quarter's amount
$\frac{1}{4}$	<u>5</u>	<u>1</u>	<u>3</u>	
	1	5	$5\frac{1}{2}$	
	<u>101</u>	<u>5</u>	<u>0</u>	
$\frac{1}{20}$	102	10	$5\frac{1}{2}$	the 2d quarter's amount
$\frac{1}{4}$	<u>5</u>	<u>2</u>	<u>6</u>	
	1	5	$7\frac{1}{2}$	
	<u>102</u>	<u>10</u>	<u>$5\frac{1}{2}$</u>	
$\frac{1}{20}$	103	15	$11\frac{1}{2}$	the 3d quarter's amount
$\frac{1}{4}$	<u>5</u>	<u>3</u>	<u>$9\frac{1}{2}$</u>	
	1	5	$11\frac{1}{2}$	
	<u>103</u>	<u>15</u>	<u>$11\frac{1}{2}$</u>	
$\frac{1}{20}$	105	1	$10\frac{1}{2}$	the 4th quarter's amount
$\frac{1}{4}$	<u>5</u>	<u>5</u>	<u>1</u>	
	1	6	$3\frac{1}{2}$	
	<u>105</u>	<u>1</u>	<u>$10\frac{1}{2}$</u>	
$\frac{1}{20}$	106	8	$1\frac{3}{4}$	the 5th quarter's amount
$\frac{1}{4}$	<u>5</u>	<u>6</u>	<u>$4\frac{3}{4}$</u>	
	1	6	7	
	<u>106</u>	<u>8</u>	<u>$1\frac{3}{4}$</u>	
$\frac{1}{20}$	107	14	$8\frac{3}{4}$	the 6th quarter's amount
$\frac{1}{4}$	<u>5</u>	<u>7</u>	<u>$8\frac{3}{4}$</u>	
	1	6	11	
	<u>107</u>	<u>14</u>	<u>$8\frac{3}{4}$</u>	
$\frac{1}{20}$	109	1	$7\frac{3}{4}$	the 7th quarter's amount
$\frac{1}{4}$	<u>5</u>	<u>9</u>	<u>$1\frac{3}{4}$</u>	
	1	7	3	
	<u>109</u>	<u>1</u>	<u>$7\frac{3}{4}$</u>	
\mathcal{L}	110	8	$10\frac{3}{4}$	the 8th quarter's amount.

COMPOUND INTEREST.

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£	(5)	£	s.	d.
450		468	0	0
<u>4</u>		<u>18</u>	<u>14</u>	<u>4½</u>
18 00		486	14	4½ 2d year's amt.
<u>450</u>		<u>4</u>		
468 1st year's amt.		19 46	17	7
<u>4</u>		<u>20</u>		
18 72		9 37		
<u>20</u>		<u>12</u>		
14 40		4 51		
<u>12</u>		<u>4</u>		
4 80		9 04		
<u>4</u>				
3 20				
486 14 4½		506	3	9½
<u>19</u>	<u>9</u>	<u>20</u>	<u>4</u>	<u>11½</u>
506 3 9½ 3d year's amt.		526	8	8½ 4th year's amt.
<u>4</u>		<u>4</u>		
20 24	15	21 05	14	10
<u>20</u>		<u>20</u>		
4 95		1 14		
<u>12</u>		<u>12</u>		
11 41		1 78		
<u>4</u>		<u>4</u>		
1 64		3 12		
		526	8	8½
		<u>21</u>	<u>1</u>	<u>1½</u>
		547	9	10½ 5th year's amt.
		450	0	0 principal
£	97	9	10½	compound int.

EQUATION OF PAYMENTS.

\pounds	\pounds
100	100
4	6
400	600
	400
	2 00)10 00
	5 months.

\pounds	$mo.$	\pounds
$200 \times 0 =$	200	
$600 \times 4 =$	2400	
$200 \times 6 =$	1200	
1000)3 800	
	$3\frac{1}{2}$ months.	

\pounds	$mo.$	\pounds
$100 \times 2 =$	200	
$80 \times 5 =$	400	
$60 \times 7 =$	420	
24 0	{ 6)102 0	
	{ 4) 17	
	$4\frac{1}{4}$ months.	

\pounds	$mo.$	\pounds
$100 \times 2 =$	200	
$200 \times 4 =$	800	
$300 \times 6 =$	1800	
$100 \times 12 =$	1200	
7 00)40 00	
	$5\frac{1}{2}$ months.	

\pounds	$mo.$	\pounds
$100 \times 4 =$	400	
$200 \times 5 =$	1000	
$600 \times 12 =$	7200	
9 00)86 00	
	$9\frac{1}{2}$ months.	

\pounds	$mo.$	\pounds
$3 1200$		
$400 \times 3 =$	1200	
$400 \times 4 =$	1600	
$400 \times 8 =$	3200	
12 00)60 00	
	5 months.	

BARTER.

Example (1) is worked.

$$(2) \quad \begin{array}{r|l} \text{d.} & \text{lb.} \\ 6 = \frac{1}{2} & 120 \text{ at } 6d. \\ & \hline 20 & 60 \\ & \hline \end{array}$$

£ 3 value of the raisins;

then, 2s. : 1 lb. :: 3l. : 30 lb.

$$(3) \quad \begin{array}{r} \text{Cwt.} \quad \text{lb.} \\ 2 = 224 \\ 224 \times 2 = 448 \\ \text{then, } \frac{448}{8} = \frac{56}{1} = 56 \text{ lb} \end{array}$$

$$(4) \quad \frac{56 \times 8}{2} = \frac{448}{2} = 224 \text{ lb.} = 2 \text{ cwt.}$$

$$(5) \quad 5 = \frac{1}{4} \mid 252 \text{ yards at } 5s.$$

£ 63 value of the cloth;

then, 6 hhds. : 63l. :: 1 gal. : 3s. 4d.

(6) First, 1 gall. : 3s. 4d. :: 6 hhds. : 63l. value of the wine; then, 252 yds. : 63l. :: 1 yd. : 5s.

(7) 8s. 4d. : 10s. :: 20d. : 2s. per lb.

(8) 20d. : 2s. :: 8s. 4d. : 10s. per yd.

$$(9) \quad \begin{array}{r|l} \text{s.} & \text{Cwt.} \\ 10 = \frac{1}{2} & 82 \text{ at } 30s. \\ & \hline & 41 \end{array}$$

123 value of the cheese
20 ready money

£ 103 value of B's raisins;

then, 5d. : 1 lb. :: 103l. : 4944 lb. = 44 cwt. 16 lb.

(10) 44 cwt. 16 lb.=4944 lb. at 5*d.* per lb.=103*l.* value of B's raisins ; then, 103*l.* + 20*l.*=123*l.* value of A's cheese; therefore, 30*s.* : 1 cwt. :: 123*l.* : 82 cwt. of cheese A must give B.

LOSS AND GAIN.

Example (1) is worked.

(2) 100*l.* : 110*l.* :: 30*s.* : 33*s.*=1*l.* 13*s.* per cwt.

$$\begin{array}{r}
 \text{(3)} \quad \begin{array}{c} \text{£} \\ 10 = \frac{1}{10} \end{array} \left| \begin{array}{c} \text{£} \text{ s. } d. \\ 1 \ 13 \ 0 \\ 3 \ 3\frac{1}{2} \ \frac{2}{5} \end{array} \right. \text{subtract} \\
 \hline
 \text{£ } 1 \ 9 \ 8\frac{1}{4} \ \frac{2}{5} \text{ per cwt.}
 \end{array}$$

(4) 100*l.* : (100*l.*—15*l.*)=85*l.* :: 6*s.* 8*d.* : 5*s.* 8*d.*

(5) 100*l.* : 115*l.* :: 6*s.* 8*d.* : 7*s.* 8*d.*

(6) First, 100*l.* : 110*l.* :: 10*l.* 10*s.* : 11*l.* 11*s.* advanced price of the tobacco per cwt.; then, 112 lb. : 11*l.* 11*s.* :: 1 lb. : 2*s.* 0*½d.*

(7) First, 112 lb. at 2*s.* 0*½d.* per lb.=11*l.* 11*s.*; then, 10*l.* 10*s.* : 11*l.* 11*s.* :: 100*l.* : 110*l.*, hence 110*l.*—100*l.*=10*l.* gain per cent.

(8) 5*s.* : (6*s.* 6*d.*—5*s.*)=1*s.* 6*d.* :: 100*l.* : 30*l.* gain per cent.

$$\begin{array}{r}
 \text{(9)} \quad \begin{array}{c} \text{s. } d. \\ 2 \ 6 \end{array} = \frac{\text{£}}{8} \left| \frac{\text{£}}{100} \right. \\
 \hline
 \text{£ } 12 \ 10 \text{ or } 12\frac{1}{2} \text{ per cent.}
 \end{array}$$

Example (1) is worked.

			£	£	
then, 1000%.	: 160%	::	300	48	A's share
			700	112	B's share

£ 160 proof.

	£	£	s.	d.	
then, 1220 <i>l.</i> : 250 <i>l.</i> ::	460	94	5	2½	980 A's share
	760	155	14	9	240 B's share

£ 250 0 0 proof.

			£	£	s.	d.	
			50	11	2	2½ 2	A's share
then, 180℥.	:	40℥.	:	60	:	13 6	B's share
			70	15	11	1½ 1	C's share

£ 40 0 0 proof.

			£	£	s.	d.	
			120	56	13	4	A's debt
			140	66	2	21 ² / ₃	B's debt
then, 720l.	340l.	:	200	94	8	10 ¹ / ₃	C's debt
			260	122	15	6 ¹ / ₃	D's debt

£ 340 0 0 proof.

SINGLE FELLOWSHIP.

(6) 1620*l.* 4*s.* 2*d.* + 2500*l.* 2*s.* 6*d.* + 4342*l.* 1*s.* 4*d.* + 4298*l.* 10*s.* 8*d.* = 12760*l.* 18*s.* 8*d.* whole stock ;

	<i>£</i>	<i>s. d.</i>	<i>£</i>	<i>s. d.</i>
then,	1620	4 2	253 18 7 $\frac{1}{2}$	834400
12760 <i>l.</i> 18 <i>s.</i> 8 <i>d.</i> : 2000 <i>l.</i> ::	2500	2 6	391 16 9 $\frac{1}{2}$	306262 $\frac{1}{4}$
	4342	1 4	680 10 5 $\frac{1}{2}$	306262 $\frac{1}{4}$
	4298	10 8	673 14 0 $\frac{1}{4}$	306262 $\frac{1}{4}$

£ 2000 0 0 proof.

$$(7) \quad \text{First, } \left\{ \begin{array}{l} \frac{1}{3} \\ \frac{1}{4} \\ \frac{1}{5} \\ \frac{1}{6} \end{array} \right. \text{ of } 2280 = \begin{array}{r} \text{£} 760 \\ 570 \\ 456 \\ 380 \end{array}$$

£ 2166 sum of the parts

	<i>£</i>	<i>£</i>	
then, 2166 <i>l.</i> : 2280 <i>l.</i> ::	760	800	A's part
	570	600	B's part
	456	480	C's part
	380	400	D's part

£ 2280 proof.

(8) 45 + 60 + 64 + 72 + 80 = 321 men in all ;

	<i>men.</i>	<i>£</i>	
	45	3375	1st party's share
	60	4500	2d party's share
then, 321 <i>men</i> : 24075 <i>£</i> ::	64	4800	3d party's share
	72	5400	4th party's share
	80	6000	5th party's share.

DOUBLE FELLOWSHIP.

Example (1) is worked.

(2) £ 120 × 4 = 480
 230 × 3 = 690
 360 × 2 = 720

£ 1890

	£	sh	d.	
then,	480	30	9	6 1/8 A's share
1890l. : 120l. ::	690	43	16	2 1/8 B's share
	720	45	14	3 1/8 C's share

£ 120 0 0 proof

(3) 12 × 6 = 72
 14 × 8 = 112
 10 × 16 = 160
 12 × 20 = 240

£ 584

	£	sh	d.	
	72	1	14	6 1/8 A's share
then, 584l. : 14l. ::	112	2	13	8 1/8 B's share
	160	3	16	8 1/8 C's share
	240	5	15	0 1/8 D's share

£ 14 0 0 proof

(4) First, £ mo. £ mo. products.
 100 × 8 = 800 = A's product
 80 × 5 + 100 × 3 = 700 = B's product
 176 × 4 + 136 × 4 = 1248 = C's product
 230 × 6 = 1380 = D's product

4128 = sum of the products

ALLIGATION MEDIAL.

then,	800			£	s.	d.	
				38	15	2½	1148 A's share
4128 :	700			33	18	3½	476 B's share
	1248	:: 200 ::		60	9	3½	2112 C's share
	1380			66	17	2½	192 D's share.

(5) First, $\frac{200}{8} = 25$; $\frac{168}{12} = 14$; $\frac{240}{6} = 40$

then, $25 + 14 + 40 = 79$ sum of their gains,

				£	s.	d.	
				25	632	18	2½ 14 A's stock
and, 79	:	2000	::	14	354	8	7½ 14 B's stock
				40	1012	13	1½ 14 C's stock

ALLIGATION MEDIAL.

(1)

Bush. s. s.
 $16 \times 6 = 96$
 $8 \times 4 = 32$

24) 128 (5 4 Ans.
 120

 .. 8
 12

24) 96 (4d.
 96

s. d.
 5 4
 $4 \times 6 = 24$

1 1 4
 6

£ 6 8 0 = 128s. proof*

* These examples are proved by Alligation Alternate; but may be proved by finding the value of the whole mixture at the mean price, which must be equal to the total value of the several ingredients, as in Example 1.

ALLIGATION ALTERNATE.

99

$$\begin{array}{r}
 (2) \\
 \text{lb. s.} \\
 2 \times 4 = 8 \\
 2 \times 5 = 10 \\
 3 \times 8 = 24 \\
 \hline
 7) \quad 42
 \end{array}$$

6s. per lb.

$$\begin{array}{r}
 (3) \\
 \text{gal. s. d. s.} \\
 36 \times 6 \text{ 6} = 234 \\
 12 \times 5 \text{ 0} = 60 \\
 12 \times 3 \text{ 0} = 36 \\
 \hline
 60 \quad 6|0|33|0
 \end{array}$$

5 6d. per gal.

$$\begin{array}{r}
 (4) \\
 \text{bu. c. c.} \\
 3 \times 18 = 54 \\
 1 \times 20 = 20 \\
 1 \times 22 = 22 \\
 3 \times 24 = 72 \\
 \hline
 8) \quad 168
 \end{array}$$

Ans. 21 caracts
— fine

$$\begin{array}{r}
 (5) \\
 \text{bu. s. d. s.} \\
 12 \times 6 \text{ 0} = 72 \\
 6 \times 5 \text{ 0} = 30 \\
 6 \times 4 \text{ 6} = 27 \\
 18 \times 3 \text{ 6} = 63 \\
 24 \times 3 \text{ 0} = 72 \\
 \hline
 66) \quad 264(4s.
 \end{array}$$

264 [ans.

$$\begin{array}{r}
 (6) \\
 \text{gal. d. d.} \\
 4 \times 16 = 64 \\
 4 \times 12 = 48 \\
 3 \times 9 = 27 \\
 1 \times 5 = 5 \\
 12 \times 4 = 48 \\
 \hline
 24) \quad 192(8d. \\
 \hline
 192 [ans.
 \end{array}$$

ALLIGATION ALTERNATE.

(1)

$$64 \left\{ \begin{array}{l} 72 \\ 48 \end{array} \right\} \left\{ \begin{array}{l} 16 \text{ wheat} \\ 8 \text{ rye} \end{array} \right\} \text{ Ans.}$$

$$\begin{array}{r}
 72 \times 16 = 1152 \\
 84 \times 8 = 384
 \end{array}$$

$$\begin{array}{r}
 \text{d.} \\
 24) \quad 1536(64 \text{ proof}^* \\
 \hline
 144 \\
 \hline
 .. 96 \\
 \hline
 96 \\
 \hline
 \end{array}$$

* These examples are proved by Alligation Medial; but may be proved as above. See first example.

ALLIGATION ALTERNATE.

(2)

$$6 \left\{ \begin{array}{l} 4 \\ 5 \\ 8 \end{array} \right\} \cdot \left\{ \begin{array}{l} 2 \\ 2 \\ 1+2=3 \end{array} \right\} = \left\{ \begin{array}{l} 2 \text{ at } 4 \\ 2 \text{ at } 5 \\ 3 \text{ at } 8 \end{array} \right\} \text{ per lb.}$$

(3)

$$66 \left\{ \begin{array}{l} d. \\ 78 \\ 60 \\ 36 \end{array} \right\} \left\{ \begin{array}{l} gal. \\ 30+6=36 \\ 12 \\ 12 \end{array} \right\} = \left\{ \begin{array}{l} s. \ d. \\ 36 \text{ at } 6 \ 6 \\ 12 \text{ at } 5 \ 0 \\ 12 \text{ at } 3 \ 0 \end{array} \right\} \text{ per gallon.}$$

(4)

$$21 \left\{ \begin{array}{l} 18 \\ 20 \\ 22 \\ 24 \end{array} \right\} \left\{ \begin{array}{l} car. \\ 3 \text{ at } 18 \\ 1 \text{ at } 20 \\ 1 \text{ at } 22 \\ 3 \text{ at } 24 \end{array} \right\} \text{ caracts fine.}$$

(5)

$$48 \left\{ \begin{array}{l} 72 \\ 60 \\ 54 \\ 42 \\ 36 \end{array} \right\} \left\{ \begin{array}{l} bu. \ s. \ d. \\ 12 \text{ at } 6 \ 0 \\ 6 \text{ at } 5 \ 0 \\ 6 \text{ at } 4 \ 6 \\ 6+12=18 \text{ at } 3 \ 6 \\ 24 \text{ at } 3 \ 0 \end{array} \right\} \text{ per b.}$$

(6)

$$8 \left\{ \begin{array}{l} d. \\ 16 \\ 12 \\ 9 \\ 5 \\ 4 \end{array} \right\} \left\{ \begin{array}{l} gal. \ d. \\ 4 \text{ at } 16 \\ 4 \text{ at } 12 \\ 3 \text{ at } 9 \\ 1 \text{ at } 5 \\ 4+8=12 \text{ at } 4 \end{array} \right\} \text{ per gallon.}$$

Questions of this sort admit of a great variety of answers, for as many different ways as you can link a greater quantity than the mean to a less, so many different answers will be obtained by the rule, and numbers in the same proportion to the differences, will likewise answer the question ad infinitum; for which reason they are called

by algebraists indeterminate, or unlimited, problems ; and by an analytical process, theorems may be raised that will give all the possible answers to these questions.

ALLIGATION PARTIAL.

$$\begin{array}{c} \text{d.} \quad \text{d.} \quad \text{bu.} \\ \text{mean } 64 \left\{ \begin{array}{l} 72 \\ 48 \end{array} \right\} \begin{array}{l} 16 \text{ wheat} \\ 8 \text{ rye} \end{array} \end{array} \quad \text{Answer.*}$$

$$\begin{array}{c} \text{diff.} \\ \text{mean } 6 \left\{ \begin{array}{l} 8 \\ 5 \\ 4 \end{array} \right\} \left. \begin{array}{l} 2+1=3 \text{ at } 8 \\ 2 \text{ at } 5 \\ 2 \text{ at } 4 \end{array} \right\} \text{1st Ans.} \end{array}$$

$$\text{Then as } 3 : 6 :: 2$$

$$\begin{array}{r} 3 \overline{)12} \end{array}$$

Answer 4 lb. of each of the other sorts.

$$\begin{array}{c} \text{d.} \quad \text{diff.} \\ 66 \left\{ \begin{array}{l} 78 \\ 60 \\ 36 \end{array} \right\} \left. \begin{array}{l} 30+6=36 \\ 12 \\ 12 \end{array} \right\} \end{array} \quad \text{As } 36 : 18 :: 12$$

$$\begin{array}{r} 36 \overline{)216} \\ \underline{6)216} \\ 6)36 \end{array}$$

6 gal. of the other
two sorts.

* When two kinds of things only are given to be mixed, the rule of Alligation will give but one answer. If three kinds of things are given to be mixed, it will give but one answer ; but all numbers in the same proportion between themselves and the numbers which compose that answer, will also satisfy the question ; therefore all the examples in this rule are proved by Alligation Medial, they being in the same proportion with those numbers.

$$\begin{array}{rcl}
 & & (4) \\
 21 \left\{ \begin{array}{l} 18 \\ 20 \\ 22 \\ 24 \end{array} \right\} & \left\{ \begin{array}{l} 9 \\ 1 \\ 1 \\ 3 \end{array} \right. & \text{As } 3 : 6 :: 1 \\
 & & \begin{array}{r} 1 \\ - \\ 3)6 \\ \hline 2 \end{array}
 \end{array}$$

$$48 \left\{ \begin{array}{l} 72 \\ 60 \\ 54 \\ 42 \\ 36 \end{array} \right\} \left. \vphantom{\begin{array}{l} 72 \\ 60 \\ 54 \\ 42 \\ 36 \end{array}} \right\}^{(5)} \begin{array}{r} 12 \\ 6 \\ 6 \\ 18 \\ 24 \end{array}$$

$$6 + 12 = 18$$

$$b. \quad b. \quad \left\{ \begin{array}{l} 6 : 12 \text{ at } 5 \ 0 \\ 6 : 12 \text{ at } 4 \ 6 \\ 18 : 36 \text{ at } 3 \ 6 \\ 24 : 48 \text{ at } 3 \ 0 \end{array} \right\} \text{per bushel.}$$

$$8 \left\{ \begin{array}{l} 16 \\ 12 \\ 9 \\ 5 \\ 4 \end{array} \right\} \left\{ \begin{array}{l} (6) \\ 4 \\ 4 \\ 3 \\ 1 \end{array} \right\} 4 + 8 = 12$$

$$g. \quad g. \quad d.$$

$$4 : 8 :: \left\{ \begin{array}{l} 4 : 8 \text{ at } 12 \\ 3 : 6 \text{ at } 9 \\ 1 : 2 \text{ at } 5 \\ 12 : 24 \text{ at } 4 \end{array} \right\} \text{per gallon.}$$

ALLIGATION TOTAL.

$$\begin{array}{rcl}
 & & (1) \\
 3 \left\{ \begin{array}{l} 4 \\ 0 \end{array} \right\} \begin{array}{l} 3 \\ 1 \end{array} & \begin{array}{l} g. \\ 4 : 16 :: \end{array} & \begin{array}{l} g. \\ 3 : 12 \text{ wine} \\ 1 : 4 \text{ water} \end{array} \\
 \hline
 \text{sum } 4 & & * \text{proof } 16 \text{ gal.}
 \end{array}$$

Or, as $\begin{array}{l} g. \\ 16 : 48 :: \end{array} \begin{array}{l} s. \\ 1 : 3 \end{array}$ mean price, given proof.

$$\begin{array}{rcl}
 & & (2) \\
 d. \left\{ \begin{array}{l} 3 \\ 4 \\ 6 \\ 10 \end{array} \right\} & \left. \vphantom{\begin{array}{l} 3 \\ 4 \\ 6 \\ 10 \end{array}} \right\} & \begin{array}{l} \text{diff} \\ 4 \\ 4 \\ 4 \\ 0+2+3=5 \end{array} \\
 & & \hline
 & & \text{sum } 17
 \end{array}$$

$$\begin{array}{rcl}
 \text{sum} & lb. & \\
 17 : 112 :: & \begin{array}{l} \text{diff. } lb. \\ \left\{ \begin{array}{l} 4 : 26 \frac{1}{4} \\ 4 : 26 \frac{1}{4} \\ 4 : 26 \frac{1}{4} \\ 5 : 32 \frac{1}{4} \end{array} \right. & \begin{array}{l} d. \\ \text{at } 3 \\ \text{at } 4 \\ \text{at } 6 \\ \text{at } 10 \end{array} \end{array} \left. \vphantom{\begin{array}{l} 4 : 26 \frac{1}{4} \\ 4 : 26 \frac{1}{4} \\ 4 : 26 \frac{1}{4} \\ 5 : 32 \frac{1}{4} \end{array}} \right\} \text{per lb.} \\
 & & \hline
 & & 112 \text{ lb. proof.}
 \end{array}$$

* The proof is had by finding the value of the whole mixture at the mean rate; which must be equal to the total value of the several simples, or if the sum of the several particulars agree with the given sum, the work is right.

Several authors have given demonstrations of this rule, but those published by Dr. Hutton, in his arithmetic, are the most intelligible of any I have yet seen.

ALLIGATION TOTAL.

$$\begin{array}{rcl}
 & & (3) \\
 \text{mean } 19 & \left\{ \begin{array}{l} 22 \\ 20 \\ 18 \\ 17 \\ 14 \end{array} \right\} & \left. \begin{array}{l} \\ \\ \\ \\ \end{array} \right\} \begin{array}{l} 2+1=3 \\ 1 \\ 1 \\ 3 \end{array} \\
 & & \text{sum } 13
 \end{array}$$

$$\begin{array}{rcl}
 \text{sum} & \text{oz.} & \\
 13 : 200 :: & \left\{ \begin{array}{l} 5 : 76\frac{2}{3} \text{ of } 22 \\ 3 : 46\frac{2}{3} \text{ of } 20 \\ 1 : 15\frac{2}{3} \text{ of } 18 \\ 1 : 15\frac{2}{3} \text{ of } 17 \\ 3 : 46\frac{2}{3} \text{ of } 14 \end{array} \right\} & \text{car. fine.} \\
 & \text{proof } 200 \text{ oz. of } 19 \text{ car. fine.} &
 \end{array}$$

$$\begin{array}{rcl}
 & & (4) \\
 56 & \left\{ \begin{array}{l} 96 \\ 72 \\ 48 \\ 24 \end{array} \right\} & \left. \begin{array}{l} 32 \\ 8 \\ 16 \\ 40 \end{array} \right\} \begin{array}{l} \text{sum} \\ 96 : 240 :: \end{array} \left\{ \begin{array}{l} 32 : 80 \text{ wheat} \\ 8 : 20 \text{ rye} \\ 16 : 40 \text{ barley} \\ 40 : 100 \text{ oats} \end{array} \right\} \text{bush.} \\
 & \text{sum } 96 & \text{bush } 240 \text{ proof.}
 \end{array}$$

$$\begin{array}{rcl}
 & & (5) \\
 16 & \left\{ \begin{array}{l} 24 \\ 21 \\ 19 \\ 0 \end{array} \right\} & \left. \begin{array}{l} 16 \\ 16 \\ 16 \\ 16 \end{array} \right\} 3+5+8=16 \\
 & & \text{sum } 64 : 190 :: 16 \\
 & & 16 \\
 & & 16 \\
 & & 16 \\
 & & 64 \left\{ \begin{array}{l} 8) 3040 \\ 8) 380 \end{array} \right. \\
 & & 47\frac{1}{2} \text{ oz. of each sort} \\
 & & 4 \\
 & & 190 \text{ oz. proof.}
 \end{array}$$

EXCHANGE.

ENGLAND WITH FRANCE.

Example (1) is worked.

- (2) 30*d.* : 1 *cr.* :: 125*l.* : 1900 *cr.*
- (3) 1 *cr.* : 30*d.* :: 280 *liv.* 13 *sol.* 4 *den.* : 12*l.*
1*s.* 8*½d.*
- (4) 31*d.* : 1 *cr.* :: 12*l.* 1*s.* 8*½d.* : 280 *liv.* 13 *sol.*
4 *den.*
- (5) 1 *cr.* : 4*s.* 2*d.* :: 2148 *cr.* 2 *liv.* 4 *sol.* 6 *den.*
: 447*l.* 13*s.* 1*½d.*
- (6) 2148 *cr.* 2 *liv.* 4 *sol.* 6 *den.* : 447*l.* 13*s.* 1*½d.*
: : 1 *cr.* : 4*s.* 2*d.*

SPAIN.

Example (1) is worked.

- (2) 6912 at 50*d.* = 1440*l.*
- (3) 1 *pia.* : 48*d.* :: 2600 *pia.* 6 *ria.* 20 *mar.* :
520*l.* 3*s.* 3*½d.*
- (4) 48*d.* : 1 *pia.* :: 520*l.* 3*s.* 3*½d.* : 2600 *pia.*
6 *ria.* 20 *mar.*
- (5) 2600 *pia.* 6 *ria.* 20 *mar.* : 520*l.* 3*s.* 3*½d.* ::
1 *pia.* : 48*d.*

PORTUGAL.

Example (1) is worked.

- (2) 14624 *mil.* at 5*s.* = 3656*l.*
- (3) 64*d.* : 1 *mil.* :: 360*l.* 4*s.* 8*d.* : 1350 *mil.*
875 *rees.*
- (4) 1 *mil.* : 64*d.* :: 1350 *mil.* 875 *rees.* : 360*l.*
4*s.* 8*d.*

HOLLAND, FLANDERS, AND GERMANY.

Example (1) is worked.

- (2) 104 guil. : 100 guil. :: 110 guil. 12 stiv. :
106 guil. 6 stiv. 1 gr. $6\frac{10}{13}$ pen.
- (3) 100 guil. : 105 guil. :: 2840 guil. : 2982 guil.
- (4) 100 guil. : 104 guil. :: 106 guil. 6 stiv. 1 gr.
 $6\frac{10}{13}$ pen. : 110 guil. 12 stiv.
- (5) $640 \times 240 \div 40 = 3840$ guil.
- (6) $3840 \times 40 \div 240 = 640$ l.
846l. 12s. 207504d.
- (7) $\frac{\quad}{40} = \frac{\quad}{40} = 5187$ guil. 12 stiv.⁴
- (8) 5187 guil. 12 stiv. $\times 40 \div 240 = 864$ l. 12s.
- (9) 350l. at 34s. = 595l.
- (10) 1l. : 33s. 6d. :: 842l. 5s. : 1410l. 15s. $4\frac{1}{2}$ d.
- (11) 34s. : 1l. :: 595l. : 350l.
- (12) 33s. 6d. : 1l. :: 1410l. 15s. $4\frac{1}{2}$ d. : 842l. 5s.
- (13) 34s. : 1l. :: 5187 flo. 12 stiv. : 508l. 11s.
 $9\frac{3}{7}$ d.
- (14) 508l. 11s. $9\frac{3}{7}$ d. : 5187 flo. 12 stiv. :: 1l. :
34s.

HAMBRO'.

Example (1) is worked.

- (2) 1l. : 32 sols gros :: 52l. : 1664 sols gros;
then, $1664 \times 6 \div 16 = 624$ marks.
- (3) 36 sols gros 1 den. : 1l. :: 1724 mks. 5 sols
lub. : 127l. 8s. $7\frac{1}{2}$ $\frac{24}{133}$ d.
- (4) 1l. : 36 sols 1 den. :: 127l. 8s. $7\frac{1}{2}$ $\frac{24}{133}$ d. :
1724 mks. 5 sols lub.

VENICE.

Example (1) is worked.

- (2) 2208 pia. at 50d. = 460l.
- (3) 1 pia. : 48d. :: 2918 pia. 10 sol. : 583l. 14s.

EXCHANGE.

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- (4) 46*d.* : 1 pia. : : 583*l.* 14*s.* : 2918 pia. 10 sol.
 (5) 1 duc. : 53*d.* : : 4780 duc. 12 sol. 6 den. :
 1055*l.* 14*s.* 5½*d.*
 (6) 53*d.* : 1 pia. : : 1055*l.* 14*s.* 5½*d.* : 4780 pia.
 12 sol. 6 den.

RUSSIA.

Example (1) is worked.

- (2) 2950 rub. at 4*s.* 2*d.* = 614*l.* 11*s.* 8*d.*
 (3) 4*s.* 6*d.* : 1 rub. : : 940*l.* 12*s.* 6*d.* : 4180 rub.
 55½ cop.
 (4) 1 rub. : 4*s.* 6*d.* : : 4180 rub. 55½ cop. :
 940*l.* 12*s.* 6*d.*

POLAND AND PRUSSIA.

Example (1) is worked.

- (2) First, 270 gros. : 1*l.* F. : : 11700 flo. :
 1300*l.* Flem.; then, 33*s.* 4*d.* : 1*l.* : : 1300*l.*
 F. : 780*l.*
 (3) First, 1*l.* : 34*s.* 4*d.* : : 875*l.* 12*s.* 6*d.* : 1503*l.*
 3*s.* 1½*d.* Flem.; then, 1*l.* : 290 gros : : 1503*l.*
 3*s.* 1½*d.* : 4843 rix-dol. 45 gros 5½ pen.
 (4) First, 290 gros : 1*l.* : : 4843 rix-dol. 45 gros
 5½ pen. : 1503*l.* 3*s.* 1½*d.* Flem.; then, 34*s.* 4*d.*
 : 1*l.* : : 1503*l.* 3*s.* 1½*d.* : 875*l.* 12*s.* 6*d.*

SWEDEN.

Example (1) is worked.

- (2) 46 cop. dol. : 1*l.* : : 11316 cop. dol. : 246*l.*
 (3) 1*l.* : 48 cop. dol. : : 293*l.* 15*s.* : 14100 cop. dol.
 (4) 48 cop. dol. : 1*l.* : : 14100 cop. dol. : 293*l.*
 15*s.*
 (5) 49 cop. dol. : 1*l.* : : 5838 sil. dol. 9 run. :
 357*l.* 8*s.* 8¾*d.*
 (6) 1*l.* : 49 cop. dol. : : 357*l.* 8*s.* 8¾*d.* : 5838
 sil. dol. 9 run.

IRELAND, AMERICA, AND THE WEST INDIES.

Example (1) is worked.

(2) $106\text{£} : 100\text{£} :: 795\text{£} : 750\text{£}.$

(3) $100\text{£} : 110\text{£} :: 751\text{£} 10\text{s.} : 826\text{£} 13\text{s.}$

(4) $110\text{£} : 100\text{£} :: 826\text{£} 13\text{s.} : 751\text{£} 10\text{s.}$

$$(5) \quad \begin{array}{r|l} \text{£} & \text{£} \\ 50 = \frac{1}{2} & 726 \text{ at } 100 \text{ per cent.} \\ & 363 \text{ at } 50 \text{ per cent.} \\ \hline & 1089 \end{array}$$

(6) $150\text{£} : 100\text{£} :: 1089\text{£} : 726\text{£}.$

(7) $160\text{£} : 100\text{£} :: 1089\text{£} 10\text{s.} : 680\text{£} 18\text{s.} 9\text{d.}$

$$(8) \quad \begin{array}{r|l} \text{£} & \text{£} \quad \text{s.} \quad \text{d.} \\ 50 = \frac{1}{2} & 680 \quad 18 \quad 9 \text{ at } 100 \text{ per cent.} \\ 10 = \frac{1}{2} & 340 \quad 9 \quad 4\frac{1}{2} \text{ at } 50 \text{ per cent.} \\ & 68 \quad 1 \quad 10\frac{1}{2} \text{ at } 10 \text{ per cent.} \\ \hline \text{£} & 1089 \quad 10 \quad 0 \end{array}$$

ARBITRATION OF EXCHANGES.

Example (1) is worked.

(2) $33\text{s.} 4\text{d.} : 1\text{£} :: 55\text{d.} : 33\text{d. per crown.}$

(3) $100\text{£} : 103\text{£} :: 33\text{s.} 4\text{d.} : 1\text{£} 14\text{s.} 4\text{d.}$

(4) $103\text{£} : 100\text{£} :: 1\text{£} 14\text{s.} 4\text{d.} : 1\text{£} 13\text{s.} 4\text{d.}$
Flem. per £ ster.

VULGAR FRACTIONS.

REDUCTION OF VULGAR FRACTIONS.

Example (1) is worked.

(2) $5\frac{2}{3} \div \frac{2}{3} \text{ ana.}$

(3) $\frac{5}{12} \times 3 = \frac{5}{4}$

(4) $3\frac{2}{3} \div \frac{2}{3} = 5$

CASE II.

$$(5) \quad 4 = \frac{4}{1}$$

$$(6) \quad 6 = \frac{6}{1}$$

$$(7) \quad 8 = \frac{8}{1}$$

$$(8) \quad 12 = \frac{12}{1}$$

CASE III.

- (9) $8 \times 4 = 32$; hence $\frac{1}{32}$ is the fraction required.
 (10) $6 \times 5 = 30$; hence $\frac{1}{30}$ is the fraction required.
 (11) $9 \times 6 = 54$; hence $\frac{1}{54}$, the answer.
 (12) $12 \times 10 = 120$; hence $\frac{1}{120}$, the answer.

CASE IV.

- (13) $\frac{1}{2}$ of $\frac{2}{3}$ of $\frac{3}{4} = \frac{1}{4}$, the single fraction.
 (14) $\frac{2}{3} \times \frac{3}{4} \times \frac{4}{5} = \frac{2}{5}$
 (15) $\frac{3}{4} \times \frac{4}{5} \times \frac{5}{6} = \frac{1}{2}$
 (16) $\frac{4}{5} \times \frac{5}{6} \times \frac{6}{7} = \frac{4}{7}$

CASE V.

$$(17) \quad 5\frac{1}{2} = \frac{5 \times 2 + 1}{2} = \frac{11}{2}$$

$$(18) \quad 6\frac{2}{3} = \frac{6 \times 3 + 2}{3} = \frac{20}{3}$$

$$(19) \quad 12\frac{1}{2} = \frac{12 \times 2 + 1}{2} = \frac{25}{2}$$

$$(20) \quad 25\frac{3}{8} = \frac{25 \times 8 + 3}{8} = \frac{203}{8}$$

CASE VI.

$$(21) \quad \frac{1}{2} = 11 + 2 = 5\frac{1}{2}$$

$$(22) \quad \frac{1}{3} = 6\frac{2}{3}$$

$$(23) \quad \frac{1}{4} = 12\frac{1}{4} \text{ or } 12\frac{3}{4}$$

$$(24) \quad \frac{1}{5} = 25\frac{1}{5}$$

CASE VII.

(25) $\frac{12}{120}$ has 24 for its common measure.

(26) $\frac{126}{182}$ has 14 for its common measure.

(27) $\frac{2146}{3842}$ has 2 for its common measure.

(28) $\frac{365}{4896}$ has 1 for its common measure

CASE VIII.

(29) $\frac{1071}{1821} = \frac{1071}{1821}$, having 1 for the common measure;
hence these numbers are prime to one another

(30) $\frac{1416}{4424} = \frac{177}{553}$

(31) $\frac{3642}{4312} = \frac{1821}{2156}$

(32) $\frac{340}{2136} = \frac{85}{534}$

(33) $\frac{816}{4446} = \frac{136}{741}$

(34) $\frac{2688}{3072} = \frac{7}{8}$

CASE IX.

(35) $\left. \begin{array}{l} \frac{2}{3} \times 4 = \frac{8}{12} \\ \frac{3}{4} \times 3 = \frac{9}{12} \end{array} \right\} \text{the fractions required.}$

(36)

$$\frac{2}{3} \times 5 \times 6 = \frac{20}{120}$$

$$\frac{3}{4} \times 4 \times 6 = \frac{96}{120}$$

$$\frac{5}{6} \times 5 \times 4 = \frac{100}{120}$$

(37)

$$\frac{1}{2} \times 3 \times 4 \times 7 = \frac{84}{168}$$

$$\frac{2}{3} \times 2 \times 4 \times 7 = \frac{112}{168}$$

$$\frac{3}{4} \times 7 \times 3 \times 2 = \frac{126}{168}$$

$$\frac{4}{7} \times 4 \times 3 \times 2 = \frac{128}{168}$$

(38)

$$\frac{1}{3} \times 4 \times 5 \times 6 = \frac{120}{360}$$

$$\frac{1}{4} \times 2 \times 5 \times 6 = \frac{90}{360}$$

$$\frac{1}{5} \times 2 \times 4 \times 6 = \frac{72}{360}$$

$$\frac{1}{6} \times 5 \times 4 \times 2 = \frac{60}{360}$$

(39)

$$\frac{5}{8} \times 9 \times 10 \times 12 = \frac{5400}{800}$$

$$\frac{7}{9} \times 8 \times 10 \times 12 = \frac{3360}{800}$$

$$\frac{10}{12} \times 12 \times 9 \times 8 = \frac{3240}{800}$$

$$\frac{12}{12} \times 10 \times 9 \times 8 = \frac{3240}{800}$$

(40)

$$\frac{1}{3} \times 4 \times 5 \times 6 \times 7 = \frac{840}{2520}$$

$$\frac{1}{4} \times 3 \times 5 \times 6 \times 7 = \frac{630}{2520}$$

$$\frac{1}{5} \times 3 \times 4 \times 6 \times 7 = \frac{504}{2520}$$

$$\frac{1}{6} \times 3 \times 4 \times 5 \times 7 = \frac{420}{2520}$$

$$\frac{1}{7} \times 3 \times 4 \times 5 \times 6 = \frac{360}{2520}$$

CASE X.

- (41) First, 3s. 6d.=42 pence, and 1l.=240 pence; hence $\frac{42}{240}$, the fraction required.
- (42) $6\frac{1}{2}$ =13 halfpence, and 1s.=24 halfpence; hence $\frac{13}{24}$, the fraction required.
- (43) 3 ro. 12 po.=432 poles, and 1 acre=160 poles; hence $\frac{432}{160}$, the fraction required.
- (44) $2 \text{ qrs. } 12 \text{ lb.} = \frac{112}{112} = \frac{68}{112}$
- (45) $8\frac{1}{2} \text{ in.} = \frac{17}{12}$
- (46) $12\frac{1}{2} \text{ cwt.} = \frac{25}{20} = \frac{5}{4} \text{ or } \frac{1}{4}$
- (47) 6 oz. 12 dwts. 16 grs.=3184 grs., and 1 lb.=5760 grs.; hence $\frac{3184}{5760}$, the fraction required.
- (48) $3 \text{ qr. } 2 \text{ lb. } 2 \text{ oz. } 6 \text{ drs.} = \frac{2204}{1 \text{ cwt.}}$

CASE XI.

- (49) $\frac{1}{2}$ of $\frac{1}{2}$ of $\frac{1}{2}$ = $\frac{1}{8}$ or $\frac{1}{8}$
- (50) $\frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$ or $\frac{1}{4}$
- (51) $\frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$ or $\frac{1}{4}$
- (52) $\frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$ or $\frac{1}{4}$
- (53) $\frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} = \frac{1}{8}$ or $\frac{1}{8}$
- (54) $\frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$ or $\frac{1}{4}$
- (55) $\frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} = \frac{1}{16}$
- (56) $\frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} = \frac{1}{32}$ or $\frac{1}{32}$
- (57) $\frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$ or $\frac{1}{4}$
- (58) $\frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$ or $\frac{1}{4}$
- (59) $\frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} = \frac{1}{8}$ or $\frac{1}{8}$
- (60) $\frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$ or $\frac{1}{4}$

CASE XII.

- (61) $3\frac{2}{3}l. = 6s. 8\frac{1}{2}d.$
 (62) $2\frac{2}{3}l. = 3s. 6d.$
 (63) $1\frac{3}{4}s. = 6\frac{1}{2}d.$
 (64) $1\frac{3}{8} \text{ acre} = 3 \text{ ro. } 12 \text{ p}$
 (65) $1\frac{2}{3} \text{ cwt.} = 2 \text{ qr. } 12 \text{ lb.}$
 (66) $1\frac{1}{4} \text{ foot} = 8\frac{1}{2} \text{ inches.}$
 (67) $2\frac{1}{2} \text{ ton} = 12\frac{1}{2} \text{ cwt.}$
 (68) $3\frac{1}{8} \text{ lb.} = 6 \text{ oz. } 12 \text{ dwt. } 16 \text{ gra.}$
 (69) $2\frac{2}{3} \frac{1}{2} \text{ cwt.} = 3 \text{ qrs. } 2 \text{ lb. } 2 \text{ oz. } 6 \text{ gra.}$
 (70) $1\frac{1}{3} \frac{1}{4} \text{ moi.} = 9s. 4\frac{1}{4} 1\frac{1}{4}d.$

ADDITION OF VULGAR FRACTIONS.

- (1) $\frac{2}{3} + \frac{1}{3} = \frac{3}{3} \text{ answer.}$
 (2) $\frac{3}{8} + \frac{5}{8} = \frac{8}{8} = 1$
 (3) $\frac{2}{3} + \frac{1}{3} = \frac{3}{3} + \frac{1}{3} = \frac{4}{3} = 1\frac{1}{3}$
 (4) $\frac{2}{3} + \frac{1}{3} = \frac{2}{3} + \frac{1}{3} = \frac{3}{3} = 1$
 (5) $\frac{1}{2} + \frac{1}{4} + \frac{1}{4} = \frac{2}{4} + \frac{1}{4} + \frac{1}{4} = \frac{4}{4} = 1$
 (6) $\frac{1}{2} + \frac{1}{3} + \frac{1}{4} + \frac{1}{6} = \frac{6}{12} + \frac{4}{12} + \frac{3}{12} + \frac{2}{12} = \frac{15}{12} = 1\frac{1}{4} = 1s. 3d.$

$$(7) \quad \begin{array}{rcl} \frac{2}{3} \text{ of } \frac{1}{2} & = & \frac{2}{3} \times \frac{1}{2} = \frac{2}{6} = \frac{1}{3} \\ \frac{1}{2} \text{ of } \frac{1}{3} & = & \frac{1}{2} \times \frac{1}{3} = \frac{1}{6} \\ \frac{1}{3} \text{ of } \frac{1}{4} & = & \frac{1}{3} \times \frac{1}{4} = \frac{1}{12} \end{array}$$

$$s. 12 \quad 6\frac{1}{2} \frac{1}{4} \text{ or } \frac{1}{2}$$

- (8) First, $\frac{1}{4}$ of a shill. $= \frac{1}{4}$ of a \mathcal{L} ; then, $\frac{1}{4} \times \frac{1}{2} + \frac{1}{8} = \frac{1}{8} + \frac{1}{8} = \frac{2}{8} = \frac{1}{4}$
 $+ \frac{1}{8} \times \frac{1}{4} = \frac{1}{32} \times \frac{1}{4} = \frac{1}{128}$
 $= 8s. 11\frac{1}{2} \frac{1}{8}d.$
 (9) $6\frac{1}{2} + 7\frac{1}{2} + 8\frac{1}{2} = 6\frac{1}{2} + 7\frac{1}{2} + 8\frac{1}{2} = 22\frac{1}{2}$
 (10) $\frac{1}{2}$ of a week $= \frac{1}{2}$ of an hour; then, $\frac{1}{2} \times \frac{1}{2} + \frac{1}{4} = \frac{1}{4} + \frac{1}{4} = \frac{2}{4} = \frac{1}{2}$
 $+ \frac{1}{4} \times \frac{1}{4} = \frac{1}{16} \times \frac{1}{4} = \frac{1}{64}$ hours.

SUBTRACTION OF VULGAR FRACTIONS.

- (1) $\frac{2}{3} - \frac{2}{3} = \frac{0}{3}$ or $\frac{1}{3}$ (2) $\frac{2}{3} - \frac{2}{3} = \frac{1}{3}$
 (3) $\frac{1}{2} - \frac{1}{2} = \frac{1}{2}$ (4) $\frac{1}{2} - \frac{1}{2} = \frac{1}{2}$
 (5) $12\frac{1}{2} - \frac{2}{3} = 6\frac{2}{3} = 6\frac{1}{2}$ (6) $14\frac{1}{2} - 8\frac{1}{2} = 6\frac{1}{2} = 6\frac{1}{2}$
 (7) $862\frac{1}{2} - 224\frac{1}{2} = 637\frac{1}{2}$ (8) $961\frac{1}{2} - 460\frac{1}{2} = 500\frac{1}{2}$
 (9) $\frac{2}{3} - \frac{1}{3} = \frac{1}{3} = \frac{1}{3}$
 (10) First, $\frac{2}{3}$ of $\frac{2}{3} = \frac{1}{3}$; then $\frac{1}{2} - \frac{1}{2} = \frac{1}{2} - \frac{1}{2} = \frac{1}{2}$
 (11) $1 - \frac{1}{2} = \frac{1}{2} = \frac{1}{2}$ or $\frac{1}{2}$
 (12) $64 - \frac{1}{2} = 63\frac{1}{2}$ or $63\frac{1}{2}$

Fractions being such, or reduced to such a state, that all the numerators represent things of the same denomination, both absolute and relative, their sum or difference must therefore be a number of such parts as the common denominator expresses; whence the reason of addition and subtraction is manifest.

MULTIPLICATION OF VULGAR FRACTIONS.

- (1) $\frac{2}{3} \times \frac{2}{3} = \frac{1}{2}$ or $\frac{1}{2}$ (2) $\frac{2}{3} \times \frac{1}{2} = \frac{1}{3}$ or $\frac{1}{3}$
 (3) $\frac{1}{2} \times \frac{2}{3} = \frac{1}{3}$ or $\frac{1}{3}$ (4) $\frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$ or $\frac{1}{4}$
 (5) $7\frac{1}{2} \times \frac{2}{3} = \frac{2}{3} \times \frac{2}{3} = \frac{1}{3} = 5\frac{1}{3}$
 (6) $3\frac{1}{2} \times 12 = \frac{2}{3} \times \frac{1}{2} = \frac{1}{3}$
 (7) $\frac{1}{2} \times \frac{2}{3} \times \frac{1}{2} = \frac{1}{3}$ or $\frac{1}{3}$
 (8) $\frac{1}{2} \times \frac{2}{3} \times \frac{2}{3} \times \frac{1}{2} = \frac{1}{3}$ or $\frac{1}{3}$
 (9) $12l. 6s. 8\frac{1}{2}d. \times 3 = 37l. 0s. 1d.$
 (10) $6l. 12s. 4\frac{1}{2}d. \times 4 = 26l. 9s. 7\frac{1}{2}d.$

DIVISION OF VULGAR FRACTIONS.

- (1) $\frac{2}{3} \times \frac{2}{3} = \frac{1}{3}$ answer. (2) $\frac{2}{3} \times \frac{1}{2} = \frac{1}{3}$ or $\frac{1}{3}$
 (3) $\frac{1}{2} \times \frac{2}{3} = \frac{1}{3}$ (4) $\frac{1}{2} \times \frac{2}{3} = \frac{1}{3}$
 (5) $7\frac{1}{2} \times \frac{2}{3} = \frac{2}{3} \times \frac{2}{3} = \frac{1}{3}$ (6) $3\frac{1}{2} \times \frac{1}{2} = \frac{2}{3} \times \frac{1}{2} = \frac{1}{3}$
 (7) $\frac{2}{3} \times \frac{2}{3} \times \frac{1}{2} = \frac{1}{3}$ (8) $\frac{1}{2}$ of $\frac{2}{3} \times \frac{2}{3} = \frac{1}{3}$
 (9) $37l. 0s. 1d. + 3 = 12l. 6s. 8\frac{1}{2}d.$
 (10) $26l. 9s. 7\frac{1}{2}d. + 4 = 6l. 12s. 4\frac{1}{2}d.$

RULE OF THREE DIRECT IN VULGAR FRACTIONS.

- (1) $\frac{1}{4}$ yd. : $\frac{2}{3}l.$:: $(2\frac{1}{2}$ yds.=) $\frac{5}{2}$: $18l.=4l.$ ans.
- (2) $1l.$: $\frac{1}{2}$ yds. :: $\frac{2}{3}l.$: $\frac{1}{4}y.$ = $\frac{1}{4}$ yd.
- (3) $4\frac{1}{2}$ yds.= $\frac{9}{2}$, $4l.$ 10s.= $4\frac{1}{2}=\frac{9}{2}$, and $11\frac{1}{2}$ yds.= $\frac{23}{2}$; then, $\frac{9}{2}$ yd. : $\frac{2}{3}l.$:: $\frac{23}{2}$ yd. : $8\frac{2}{3}l.=10\frac{1}{3}l.$
- (4) $100l.$: $4\frac{1}{2}l.$:: $240l.$: $\frac{2160}{200}l.=10l.$ 16s.
- (5) First, $1l.$ 15s.= $\frac{3}{8}$, and $52l.$ 10s.= $\frac{1050}{8}$; then, $\frac{3}{8}l.$: 1^o d. :: $\frac{1050}{8}l.$: $\frac{210000}{700}d.=300$ days.
- (6) 24^o d. : $\frac{1050}{8}l.$:: 1^o d. : $\frac{100000}{792}l.=1l.$ 15s.
- (7) $\frac{7}{8}l.$: 7^o gal. :: 11^o : $\frac{158400}{792}$ gal.=200 gall.
- (8) 24^o gal. : 11^o :: 7^o gal. : $\frac{79200}{200}l.=39l.$ 12s.
- 9) 24^o : $\frac{1}{8}$ ship :: $747l.$: $\frac{747}{1494}$ ship= $\frac{1}{2}$ of her.
- (10) First, $40\frac{1}{2}=\frac{81}{2}$, $1l.$ 15s.= $1\frac{1}{4}=\frac{3}{4}$, and $24\frac{1}{2} \times 50=\frac{2450}{2}$; then, $\frac{81}{2}$ ft. : $\frac{3}{4}l.$:: $\frac{2450}{2}$ ft. : $\frac{34300}{48}l.=52l.$ 18s. $7\frac{1}{2}d.$
- (11) $\frac{1}{2}$ cwt. : $\frac{2}{3}l.$:: $\frac{1}{4}$ cwt. : $\frac{1800}{112}l.=16l.$ 17s. 6d.
- (12) First, $16l.$ 17s. 6d.= $\frac{948}{56}l.$, $11\frac{1}{4}=\frac{45}{4}$, and 5 gui.= $\frac{21}{4}$; then, $\frac{948}{56}l.$: $\frac{45}{4}$ cwt. :: $\frac{21}{4}l.$: $\frac{52940}{13120}$ cwt.= $3\frac{1}{2}$ cwt.

RULE OF THREE INVERSE IN VULGAR FRACTIONS.

Example (1) is worked.

- (2) First, $6\frac{2}{3}=\frac{20}{3}$, and $2\frac{1}{2}=\frac{5}{2}$; then, $\frac{20}{3}$ yd. : $\frac{5}{2}$ yd. w. :: $\frac{5}{2}$ yd. : $\frac{1000}{600}$ yd. w.=2 yards, ans.
- (3) First, $40 \times 5\frac{1}{2}=220$ yds., and $4 \times 5\frac{1}{2}=22$ yds.; then $\frac{22}{1}$ yd. : $\frac{220}{1}$ yd. :: $\frac{22}{3}$ yd. : $\frac{9080}{330}=293\frac{1}{3}$ yds. long.
- (4) First, $50\frac{3}{4}=\frac{152}{4}l.$, $6\frac{1}{2}=\frac{27}{4}$ mo., and $21\frac{1}{2}=\frac{43}{2}l.$; then $\frac{152}{4}l.$: $\frac{27}{4}l.$:: $\frac{43}{2}l.$: $\frac{8208}{516}$ mo.=15 mo. 3 wks. $4\frac{1}{3}$ days.

RULE OF FIVE IN VULGAR FRACTIONS.

Example (1) is worked.

(2) First, $26l. 5s. = 26\frac{1}{2} = 1\frac{10}{2}$
 then, $* 7\frac{10}{10}l. : 1\frac{10}{2}l. :: 1\frac{10}{1}l.$
 $* \frac{1}{1}l. : 1\frac{10}{2}l. :: \frac{1}{1}$

$$\therefore \frac{1\frac{10}{2} \times 1\frac{10}{1} \times 1\frac{10}{2}}{7\frac{10}{10} \times \frac{1}{1}} = \frac{126000}{6300} = 12\frac{6000}{2000} = 5l. \text{ ans.}$$

(3) First, $25\frac{1}{2} = 5\frac{1}{2}$
 then, $* 1\frac{1}{1} : 5\frac{1}{2} :: 2\frac{1}{2}$
 $* \frac{1}{1} : \frac{1}{1} :: \frac{1}{1}$
 $\therefore \frac{2\frac{1}{2} \times 2\frac{1}{1} \times 5\frac{1}{2}}{1\frac{1}{1} \times \frac{1}{1}} = \frac{5\frac{1}{2} \times 5\frac{1}{2}}{1} = 5\frac{1}{2} \times 5\frac{1}{2} = 49\frac{1}{4} \text{ rods.}$

(4) $\begin{matrix} \text{wks.} & \mathcal{L} & \text{wks.} \\ * 4\frac{2}{1} & : 2\frac{1}{1} & : : 2\frac{2}{1} \\ * 1\frac{2}{1} & : \frac{1}{1} & : : 2\frac{2}{1} \end{matrix}$
 $\therefore \frac{2\frac{1}{1} \times 2\frac{2}{1} \times 2\frac{2}{1}}{4\frac{2}{1} \times 1\frac{2}{1}} = \frac{61\frac{8}{1} \times 40}{50\frac{4}{1}} = 1226\frac{3}{4}l. = 1226l. 13s. 4d.$

(5) $\begin{matrix} s. & \mathcal{L} & s. \\ * \frac{1}{1} & : \frac{1}{1} & : : 4\frac{2}{1} \\ \frac{1}{1}d. & : \frac{1}{1} & : : \frac{1}{1}d. \end{matrix}$
 $\therefore \frac{4\frac{2}{1} \times \frac{1}{1} \times \frac{1}{1}}{\frac{1}{1} \times \frac{1}{1}} = \frac{37\frac{8}{1}}{1\frac{1}{1}} = 35 \text{ tailors.}$

(6) First, $6\frac{1}{2} = 1\frac{1}{2}$
 then, $* \frac{1}{1} \text{ cwt.} : 1\frac{1}{2}d. : : \frac{1}{1} \text{ cwt.}$
 $* 2\frac{1}{1} \text{ m.} : \frac{1}{1} : : 1\frac{1}{1} \text{ m.}$
 $\therefore \frac{1\frac{1}{2} \times \frac{1}{1} \times 1\frac{1}{1}}{\frac{1}{1} \times 2\frac{1}{1}} = \frac{65\frac{0}{1}}{2\frac{1}{1}} = 13s. 6\frac{1}{2}d.$

† For the division of this fraction by $\frac{1}{2}$, and also for the succeeding questions, see Rule, page 128. Arithmetician's Guide.

DECIMAL FRACTIONS.

ADDITION OF DECIMALS.

$$\begin{array}{r} \text{(1)} \\ 447.93 \\ \hline \end{array}$$

$$\begin{array}{r} \text{(2)} \\ 46.737 \\ \hline \end{array}$$

$$\begin{array}{r} \text{(3)} \\ 4594.5 \\ \hline \end{array}$$

$$\begin{array}{r} \text{(4)} \\ 7.479 \\ \hline \end{array}$$

$$\begin{array}{r} \text{(5)} \\ 49.131 \\ \hline \end{array}$$

$$\begin{array}{r} \text{(6)} \\ 474.30 \\ \hline \end{array}$$

SUBTRACTION OF DECIMALS.

$$\begin{array}{r} \text{(1)} \\ 442.7 \\ \hline \end{array}$$

$$\begin{array}{r} \text{(2)} \\ 55.301 \\ \hline \end{array}$$

$$\begin{array}{r} \text{(3)} \\ 7.6216 \\ \hline \end{array}$$

$$\begin{array}{r} \text{(4)} \\ 7.833 \\ \hline \end{array}$$

$$\begin{array}{r} \text{(5)} \\ 65179 \\ \hline \end{array}$$

$$\begin{array}{r} \text{(6)} \\ 4485.4 \\ \hline \end{array}$$

MULTIPLICATION OF DECIMALS.

(1) $3046825 \times 234 = 71295705$ answer.

(2) $3046825 \times 23.4 = 71295705$

(3) $431162163 \times 2.48 = 106928216424$

(4) $324637254 \times .567 = 184069323018$

(5) $478.216243 \times 123456789 = 59039041808423727$

(6) $1234.56789 \times 487.216243 = 59039041808423727$

CONTRACTIONS.

(1)
 3046825 multiplicand.
 432 multiplier inverted.

6093
 914
 121

71.28 product.

(2)
 9046825 multiplicand.
 4.32 multiplier inverted.

609
 91
 12

7.12 product.

(3)
 431162163
 84.2

86
 17
 3

1.06 product.

(4)
 324637254
 765.0

162
 19
 2

.183 product.

(5)
 478.216243
 9876543.21

4782162
 956432
 143464
 19128
 2391
 286
 33
 3

5903.899 product.

(6)
 1234.56789
 342612.874

493827
 86419
 9876
 246
 12
 7

590387. product.

DIVISION OF DECIMALS.

Example (1) is worked.

$$(2) \quad 31415926 + 579 \cdot 26 = 54234 \cdot 5 \text{ answer.}$$

$$(3) \quad 3 \cdot 1415926 + 57926 = \cdot 0000542$$

$$(4) \quad 3 \cdot 1415926 + 57 \cdot 926 = \cdot 542$$

$$(5) \quad 31415926 + \cdot 57926 = 54234 \cdot 585$$

$$(6) \quad 31 \cdot 415926 + \cdot 57926 = 5 \cdot 42345$$

$$(7) \quad \cdot 31415926 + 57926 = \cdot 00000542$$

$$(8) \quad \cdot 31415926 + 5 \cdot 7926 = \cdot 0542$$

$$(9) \quad \cdot 31415926 + \cdot 57926 = \cdot 542$$

CONTRACTIONS.

(1)

$$412 \cdot 35678 \overline{) 12884 \cdot 970983029794} (31 \cdot 24$$

12370

514

412

102

82

20

16

4

-

DIVISION OF DECIMALS.

119

(2)
~~232~~14678)5445418058704098(~~23~~45
 4642

803

696

107

92

15

11

4

-

(3)
 123456789)59099041808423727(~~4~~7821
 49382

9657

8641

1016

987

29

24

5

1

4

-

REDUCTION OF DECIMALS

(4)

478216243)59039041808423727(123456789
 478216243

112174175
 95643248

16530927
 14346487

2184440
 1912864

271576
 239108

32468
 28692

3776
 3347

429
 382

47
 42

5
 -

REDUCTION OF DECIMALS.

CASE I.

(1)
 4)1.00

.25 ans.

(2)
 2)1.0

.5

(3)

$$\begin{array}{r} 4 \overline{) 3.00} \\ \underline{.75} \end{array}$$

(4)

$$\begin{array}{r} 3 \overline{) 1.0000} \\ \underline{.3333, \&c.} \end{array}$$

(5)

$$\begin{array}{r} 12 \overline{) 7.0000} \\ \underline{.5833} \end{array}$$

(6)

$$193 \overline{) 14.0000} (.0725$$

(7)

$$\begin{array}{r} 6\frac{3}{4} \\ \underline{4} \\ 4 \overline{) 27.00} \\ \underline{6.75} \end{array}$$

(8)

$$\begin{array}{r} 8\frac{4}{12} \\ \underline{12} \\ 12 \overline{) 100.000} \\ \underline{8.333} \end{array}$$

(9)

$$3842 \overline{) 226.0000} (.0588$$

(10)

$$4806 \overline{) 2402.000} (.0499$$

To reduce a decimal to a vulgar fraction, is no more than to divide by the greatest common measure; the denominator of the decimal being 10, 100, 1000, &c. as in example (1) $\frac{.25}{100} =$ in its lowest terms, $\frac{1}{4}$, the vulgar fraction given.

CASE II.

(1)

$$\begin{array}{r} 12 \overline{) 4.000} \\ \underline{.333 \text{ ans.}} \end{array}$$

(2)

$$\begin{array}{r} 6\frac{1}{2} \\ \underline{2} \\ 24 \left\{ \begin{array}{l} 4 \overline{) 13.00} \\ \underline{3.250} \\ 6 \overline{) 3.250} \\ \underline{.5416} \end{array} \right. \end{array}$$

$$\begin{array}{r} (3) \\ 12 \overline{) 10 \cdot 000} \\ \underline{833} \\ 166 \\ \underline{0} \end{array}$$

$$\begin{array}{r} (4) \\ 5\frac{1}{2} \\ 2 \\ \hline 24 \left\{ \begin{array}{l} (4) 11 \cdot 00 \\ \hline (6) 2 \cdot 7500 \\ \hline \end{array} \right. \\ \hline \cdot 4583 \\ \hline \end{array}$$

$$\begin{array}{r} (5) \\ 36 = \left\{ \begin{array}{l} (6) 6 \\ \hline (6) 1 \cdot 000 \\ \hline \end{array} \right. \\ \cdot 166 \\ \hline \end{array}$$

$$\begin{array}{r} (6) \\ 9\frac{1}{2} \\ 2 \\ \hline 72 = \left\{ \begin{array}{l} (6) 19 \cdot 000 \\ \hline (12) 3 \cdot 166 \\ \hline \end{array} \right. \\ \cdot 263 \\ \hline \end{array}$$

$$(7) \\ 1760 \overline{) 220 \cdot 00} (\cdot 125$$

$$(8) \\ 1760 \overline{) 660 \cdot 00} (\cdot 375$$

$$\begin{array}{r} (9) \\ 20 \overline{) 18 \cdot 0} \\ \underline{9} \\ 0 \end{array}$$

$$\begin{array}{r} (10) \\ \begin{array}{cc} s. & d. \\ 16 & 9 \\ 12 & \end{array} \\ \hline 240 \overline{) 201 \cdot 00} (\cdot 83 \\ \hline \end{array}$$

$$\begin{array}{r} (11) \\ 12 \overline{) 8 \cdot 000} \\ \underline{666} \\ 134 \\ \underline{0} \end{array}$$

$$\begin{array}{r} (12) \\ lb. \quad dw. \\ 1 = 240 \overline{) 6 \cdot 00} (\cdot 025 \end{array}$$

REDUCTION OF DECIMALS.

123

$$\begin{array}{r} (13) \\ 112 \overline{) 14 \cdot 000} \cdot 125 \end{array}$$

$$\begin{array}{r} (14) \\ 16 \left\{ \begin{array}{l} 4) 6 \cdot 0 \\ \hline 4) 1 \cdot 500 \\ \hline 375 \end{array} \right. \end{array}$$

$$\begin{array}{r} (15) \\ \text{ton} \quad \text{gall.} \\ 1 = 252 \overline{) 70 \cdot 00} \cdot 27 \end{array}$$

$$\begin{array}{r} (16) \\ \text{year} \quad \text{days} \\ 1 = 365 \overline{) 90 \cdot 0} \cdot 2465 \end{array}$$

$$\begin{array}{r} (17) \\ \text{day} \quad \text{hours} \\ 1 = 24 \overline{) 9 \cdot 000} \cdot 375 \end{array}$$

$$\begin{array}{r} (18) \\ \text{day} \quad \text{min.} \\ 1 = 1440 \overline{) 8 \cdot 000} \cdot 0055 \end{array}$$

$$\begin{array}{r} (19) \\ \text{qt.} \quad \text{p.} \\ 4 \quad 1 \\ 2 \\ \text{bar.} \quad \text{pts.} \quad \text{---} \\ 1 = 256 \overline{) 9 \cdot 000} \cdot 035 \end{array}$$

$$\begin{array}{r} (20) \\ \text{acre} \quad \text{poles} \\ 1 = 160 \overline{) 26 \cdot 00} \cdot 162 \end{array}$$

CASE III.

$$\begin{array}{r} (1) \\ \cdot 333 \\ 12 \\ \hline \text{inches} \quad 4 \cdot 000 \text{ ans.} \\ \hline \end{array}$$

$$\begin{array}{r} (2) \\ \cdot 5416 \\ 12 \\ \hline 6 \cdot 5000 \\ 4 \\ \hline 2 \cdot 0000 = 6 \frac{1}{2} \text{ in.} \\ \hline \end{array}$$

$$\begin{array}{r} (3) \\ \cdot 833 \\ 12 \\ \hline 10 \cdot 000 \text{ inches.} \\ \hline \end{array}$$

(4)

$$\begin{array}{r}
 .4583 \\
 12 \\
 \hline
 5.5000 \\
 4 \\
 \hline
 2.0000 = 5\frac{1}{2} \text{ inches.} \\
 \hline
 \end{array}$$

(5)

$$\begin{array}{r}
 .166 \\
 6 \times 6 = 36 \\
 \hline
 1.000 \\
 6 \\
 \hline
 6.000 \text{ inches.} \\
 \hline
 \end{array}$$

(6)

$$\begin{array}{r}
 .263 \\
 6 \times 6 = 36 \\
 \hline
 1578 \\
 6 \\
 \hline
 9.468 \\
 4 \\
 \hline
 1.872 = 9\frac{1}{2} \text{ inches.} \\
 \hline
 \end{array}$$

(7)

$$\begin{array}{r}
 .125 \\
 1760 \\
 \hline
 7500 \\
 875 \\
 125 \\
 \hline
 220.000 \text{ yards.} \\
 \hline
 \end{array}$$

(8)

$$\begin{array}{r}
 1760 \\
 .375 \\
 \hline
 660.000 \text{ yards.} \\
 \hline
 \end{array}$$

(9)

$$\begin{array}{r}
 .9 \\
 20 \\
 \hline
 18.0 \text{ shillings.} \\
 \hline
 \end{array}$$

(10)

$$\begin{array}{r}
 .83 \\
 20 \\
 \hline
 16.60 \\
 12 \\
 \hline
 7.20 = 16s. 7d. \\
 \hline
 \end{array}$$

(11)

$$\begin{array}{r}
 .666 \\
 12 \\
 \hline
 8.000 \text{ oz.} \\
 \hline
 \end{array}$$

REDUCTION OF DECIMALS.

125

$$\begin{array}{r}
 (12) \\
 .025 \\
 .12 \\
 \hline
 .300 \\
 .20 \\
 \hline
 6.000 \text{ dwt.} \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 (13) \\
 .125 \\
 .112 \\
 \hline
 14.000 \text{ lb.} \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 (14) \\
 .375 \\
 .16 \\
 \hline
 6.000 \text{ oz.} \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 (15) \\
 252 \text{ gal.} = 1 \text{ tun.} \\
 .27 \\
 \hline
 68.05 \text{ gals.} \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 (16) \\
 .2465 \\
 .365 \\
 \hline
 89.9725 \text{ days.} \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 (17) \\
 .375 \\
 .24 \\
 \hline
 9.000 \text{ hours.} \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 (18) \\
 .005 \\
 .24 \\
 \hline
 0.120 \\
 .60 \\
 \hline
 7.200 \text{ minutes.} \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 (19) \\
 .035 \\
 256 = \text{pints in 1 bar.} \\
 \hline
 8.960 \text{ pints.} \\
 \hline
 \end{array}$$

126 SQUARE ROOT OF VULGAR FRACTIONS.

(20)

$$\begin{array}{r} \cdot 162 \\ 160 \\ \hline 25 \cdot 920 \text{ poles.} \\ \hline \end{array}$$

EXTRACTION OF THE SQUARE ROOT.

Example (1) is worked.

- (2) $\sqrt{1728} = 41 + *$ ans. (3) $\sqrt{3456} = 58 +$
 (4) $\sqrt{49864} = 223 +$ (5) $\sqrt{345678} = 587 \cdot 94$
 (6) $\sqrt{4567893} = 2137 +$
 (7) $123456789 = 11111 \cdot 11106 +$
 (8) $\sqrt{987654321} = 993 \cdot 807990006 +$
 (9) $\sqrt{123456789123456789} = 351365606062199532$
 69435 +

SQUARE ROOT OF VULGAR FRACTIONS.

(1) $\sqrt{\frac{9}{16}} = \frac{3}{4}$, the root.

(2) $\sqrt{\frac{16}{25}} = \frac{4}{5}$, the root.

(3) $\sqrt{\frac{16}{25}} = \frac{4}{5}$, the root.

(4) $\sqrt{\frac{16}{25}} = \frac{4}{5}$, the root.

(5) $\sqrt{\frac{16}{25}} = \frac{4}{5}$, or $\frac{6}{7}$ the root.

(6) $6\frac{1}{4} = \frac{25}{4}$; then $\sqrt{\frac{25}{4}} = \frac{5}{2} = 2\frac{1}{2}$, the root.

* When a cross appears after the answer, it signifies a remainder; or that the given number is not a complete power; therefore, the root may be continued to any number of places of decimals.

SURDS.

(1)
First, $\frac{96}{120} = \frac{2}{3}$, in its lowest terms; and $\frac{2}{3}$, reduced to a decimal = .6.

$$\begin{array}{r} \cdot 800000 \text{ (.894, ans.)} \\ 64 \\ \hline 169 \overline{) 1600} \\ 1521 \\ \hline 1784 \overline{) 7900} \\ 7136 \\ \hline 764 \end{array}$$

(2)
First, $\frac{3}{4}$, reduced to a decimal = .75; then

$$\begin{array}{r} 38 \cdot 7500 \text{ (6.22)} \\ 36 \\ \hline 122 \overline{) 275} \\ 244 \\ \hline 1242 \overline{) 3100} \\ 2484 \\ \hline 616 \end{array}$$

(3) First, $86\frac{1}{2} = 86.5$; then, $\sqrt{86.5} = 9.3$

(4) First, $\frac{9}{12} = \frac{3}{4} = .75$; then, $\sqrt{462.75} = 21.51$

(5) $\sqrt{26} = 5\frac{2}{3}$

USE OF THE SQUARE ROOT.

CASE I.

(1) $\sqrt{32 \times 18} = \sqrt{256} = 24$, ans.

(2) $\sqrt{20 \times 12} = \sqrt{240} = 15.49$

(3) $\sqrt{6 \times 4} = \sqrt{24} = 4.898$

(4) $\sqrt{18.5 \times 12.5} = \sqrt{231.25} = 15.2$

(5) $\sqrt{40 \times 30} = \sqrt{1200} = 34.6$

CASE II.

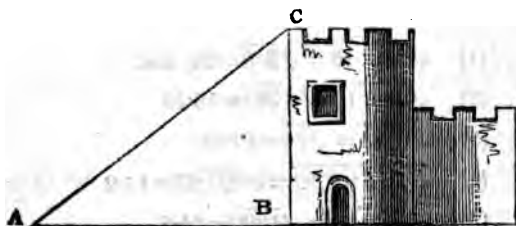
- (1) $\sqrt{576}=24$ (2) $\sqrt{240}=15.49$
 (3) $\sqrt{24}=4.89$ (4) $\sqrt{231.25}=15.2$

CASE III.

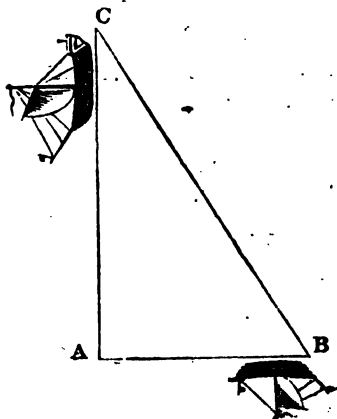
- (1) First, $1 : 1.2732 :: 576 : 733.3632$; then,
 $\sqrt{733.3632}=27.09$, the diameter.
 (2) $355 : 452 :: .7854 : 1$ \therefore , $\sqrt{1}=1$, the
 diameter.
 (3) $1 : 1.2732 :: 38.5 : 49.0182$; then,
 $\sqrt{49.0182}=7$, in the diameter.
 (4) $1 : 1.2732 :: 363.05 : 462.23526$; then,
 $\sqrt{462.23526}=21.499$ inches, diameter.

CASE IV.

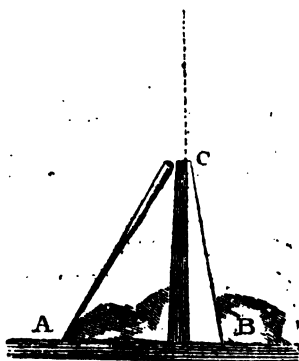
- (1) $\sqrt{48^2 + 20^2} = \sqrt{2704} = 52$ yards.
 (2) $\sqrt{52^2 - 48^2} = \sqrt{400} = 20$ yards.
 (3) $\sqrt{52^2 - 20^2} = \sqrt{2304} = 48$ yards.
 (4) $\sqrt{40^2 + 30^2} = \sqrt{2500} = 50$ yards, A C.



(5) $\sqrt{60^2 - 40^2} = \sqrt{2000} = 44 \text{ lea.} = B C.$



(6) $\sqrt{25^2 - 15^2} = \sqrt{400} = 20 \text{ feet, the length of the piece left standing; hence, } 20 + 25 = 45, \text{ the whole length.}$



(7) First, $13s. 0\frac{1}{2}d. = 625 \text{ farthings; then, } \sqrt{625} = 25$
men; hence each man paid 25 farthings, or $6\frac{1}{4}d.$

180 EXTRACTION OF THE CUBE ROOT.

- (8) First, $11l. 5s. 4d. = 2704$ pence; then, $\sqrt{2704} = 52$ men, \therefore each man paid $52d.$, or $4s. 4d.$
- (9) $\sqrt{321489} = 567$ men.
- (10) $\sqrt{24 \times 16 \times 14} = \sqrt{5376} = 73.3$ feet, the quantity of light required.

	(11)	
22 head.	2)30 length.	
26 bung.	—	Then, $24^2 = 576$
—	15 half.	$15^2 = 225$
2)48	—	—
—		$\sqrt{801} = 28.3$ diag.
24 half sum.		— [required.]

EXTRACTION OF THE CUBE ROOT.

Example (1) is worked.

- | | |
|---|--------------------------------|
| (2) $\sqrt[3]{2197} = 13$ ans. | (3) $\sqrt[3]{2744} = 14$ |
| (4) $\sqrt[3]{2985984} = 144$ | (5) $\sqrt[3]{75686967} = 423$ |
| (6) $\sqrt[3]{644972544} = 864$ | (7) $\sqrt[3]{50243409} = 369$ |
| (8) $\sqrt[3]{12862247607} = 2343$ | |
| (9) $\sqrt[3]{163039787847} = 5463$ | |
| (10) $\sqrt[3]{50023150823736} = 36846$ | |
| (11) $\sqrt[3]{94996712418949125} = 456285$ | |
| (12) $\sqrt[3]{94997087172244118016} = 4562856$ | |
| (13) $\sqrt[3]{3.46} = 1.51$ | |
| (14) $\sqrt[3]{50375.533} = 36.9$ | |
| (15) $\sqrt[3]{163040.819968} = 54.63$ | |
| (16) $\sqrt[3]{8151.613} = 20.12$ | |
| (17) $\sqrt[3]{.01286226891} = .2343$ | |
| (18) $\sqrt[3]{163.04} = 5.463$ | |

TO EXTRACT THE CUBE ROOT OF VULGAR FRACTIONS.

$$\sqrt[3]{\frac{8}{27}} = \frac{2}{3}, \text{ the root.} \quad \sqrt[3]{\frac{27}{8}} = \frac{3}{2}, \text{ the root.}$$

$$\sqrt[3]{\frac{125}{4}} = \frac{5}{2}, \text{ the root.} \quad \sqrt[3]{\frac{27}{125}} = \frac{3}{5}, \text{ the root.}$$

$$\text{First, } \sqrt[3]{\frac{72}{49}} = \frac{2}{7}; \text{ then, } \sqrt[3]{\frac{27}{49}} = \frac{3}{7}, \text{ the root.} \quad \text{First, } \sqrt[3]{\frac{108}{125}} = \frac{2}{5}; \text{ then, } \sqrt[3]{\frac{27}{125}} = \frac{3}{5}, \text{ the root.}$$

$$\text{First, } \sqrt[3]{\frac{32}{8}} = \frac{2}{2}; \text{ then, } \sqrt[3]{\frac{27}{8}} = \frac{3}{2} = 1\frac{1}{2}, \text{ the root.} \quad \text{First, } \sqrt[3]{\frac{91}{8}} = \frac{4}{2}; \text{ then, } \sqrt[3]{\frac{27}{8}} = \frac{3}{2} = 1\frac{1}{2}, \text{ the root.}$$

THE USE OF THE CUBE ROOT.

CASE I.

- (1) $\sqrt[3]{2197} = 13$ inches, answer.
- (2) $\sqrt[3]{2744} = 14$ inches.

CASE II.

- (3) $4^3 : 9 :: 7^3 : 48 \cdot 234 \text{ lb.}$
- (4) $80^3 : 500 :: 100^3 : 976 \cdot 56 \text{ tons.}$
- (5) $89 \cdot 1 : 40^3 :: 100 : 71829 \cdot 4$; then, $\sqrt[3]{71829 \cdot 4} = 41 \cdot 5$, the diameter required; again, $89 \cdot 1 : 20^3 :: 100 : 8978 \cdot 6$; then, $\sqrt[3]{8978 \cdot 6} = 20 \cdot 78$, the depth required.

CASE III.

- (6) $\sqrt[3]{5^3 \times 2} = \sqrt[3]{250} = 6 \cdot 29$, the side required.
- (7) $\sqrt[3]{6^3 + 2} = \sqrt[3]{125 \cdot 023} = 5$ feet.

- (8) First, $\sqrt[3]{250^3+2}=\sqrt[3]{7812500}=198$, keel
 2dly, $\sqrt[3]{50^3+2}=\sqrt[3]{62500}=39$, midship beam
 3dly, $\sqrt[3]{30^3+2}=\sqrt[3]{13500}=23.8$, depth in the hold.

—

CASE IV.

- (9) First, $108 \div 4 = 27$, and $\sqrt[3]{27} = 3$; then, $3 \times 4 = 12$, less mean, and $12 \times 3 = 36$, greater mean; for
 $1 : 12 :: 36 : 108$ proof.
- (10) First, $500 \div 4 = 125$, and $\sqrt[3]{125} = 5$; then, $5 \times 4 = 20$, less mean, and $20 \times 5 = 100$, greater mean;
 for $4 : 20 :: 100 : 500$ proof.

TO EXTRACT THE ROOTS OF POWERS IN
 GENERAL.

Example (1) is worked.

(2)

$$\begin{array}{r} 32015587041(423 \text{ root.} \\ 256=4^4 \end{array}$$

$$4^3 \times 4 = 256) \ 641 \text{ dividend.}$$

$$\begin{array}{r} 3111696 = 42^4 \end{array}$$

$$42^3 \times 4 = 296352) \ 898627 \text{ second dividend.}$$

$$\begin{array}{r} 22015587041 \end{array}$$

(3)

$$\begin{array}{r} 13542593318343(423 \text{ root.} \\ 1024=4^5 \end{array}$$

$$4^4 \times 5 = 1280) \ 3302 \text{ dividend.}$$

$$130691232 = 42^5$$

$$42^4 \times 5 = 15558480) \ 47347011 \text{ second dividend.}$$

$$13542593318343$$

(4)

$$\begin{array}{r} 5728516973659089(423 \text{ root.} \\ 4096=4^6 \end{array}$$

$$4^5 \times 6 = 6144) 16325 \text{ dividend.}$$

$$5489031744 = 42^6$$

$$42^5 \times 6 = 784147392) \ 2394852296 \text{ second dividend.}$$

$$5728516973659089$$

(5)

$$\begin{array}{r} 2423162679857794647(423 \text{ root.} \\ 16384=4^7 \end{array}$$

$$4^6 \times 7 = 28672) \ 78476 \text{ dividend.}$$

$$230539333248 = 42^7$$

$$42^6 \times 7 = 38423222208) \ 117769347377 \text{ second dividend.}$$

$$2423162679857794647$$

194 SINGLE RULE OF THREE IN DECIMALS.

(6)

$$\begin{array}{r} 1024997813579847135681(423 \\ 65536=4^8 \end{array} \quad \begin{array}{l} \\ \text{[root.} \end{array}$$

$$4^7 \times 8 = 131072) \ 359637 \text{ dividend.}$$

$$9682651996416 = 42^8$$

$$42^7 \times 8 = 1844314665984) \ 5673161393824 \text{ second divid.}$$

$$1024997813579847135681$$

(7)

$$\begin{array}{r} 433574075144275338393063(423 \\ 262144=4^9 \end{array} \quad \begin{array}{l} \\ \text{[root.} \end{array}$$

$$4^8 \times 9 = 589824) \ 1714300 \text{ dividend.}$$

$$406671383849472 = 42^9$$

$$42^8 \times 9 = 87143867967714) \ 268926912947933 \text{ second div.}$$

$$433574075144275338393063$$

SINGLE RULE OF THREE IN DECIMALS.

Example (1) is worked.

(2) $4l. : 2.5 \text{ yds.} :: 4l. : .25 \text{ yds.} = \frac{1}{4} \text{ yd. ans.}$

(3) First, $4\frac{3}{4} = 4.75$, $4l. 10s. = 4.5$, and $11\frac{1}{2} = 11.5$;
then, $4.75 \text{ yds.} : 4.5l. :: 11.5 \text{ yds.} :$
 $10.89l.$

(4) $100l. : 4.5l. :: 240l. : 10.8l. = 10l. 16s.$

RULE OF FIVE IN DECIMALS.

135

- (5) First, 1*l.* 15*s.*=1·75, and 52*l.* 10*s.*=52·5; then,
1·75*l.* : 10 days :: 52·5*l.* : 300 days.
- (6) 300 days : 52·5*l.* :: 10 days : 1·75*l.*=1*l.* 15*s.*
- (7) 39·6*l.* : 72 galls. :: 110*l.* : 200 galls.
- (8) 200 galls. : 110*l.* :: 72 galls. : 39·6*l.*=39*l.* 12*s.*
- (9) 22 yds. : 220 yds. :: 16·5 yds. : 293·33 yds.
- (10) $\frac{1}{6}$ =·166 &c.; then, 249*h.* : ·166 ship :: 747*l.* : 4998= $\frac{1}{2}$ of hier.
- (11) 40·5 ft. : 1·75*l.* :: 24·5 ft. : 52·932*l.*=52*l.* 18*s.* 7½*d.*
- (12) 3·5 cwt. : 5·25*l.* :: 2·25 cwt. : 16·875*l.*=16*l.* 17*s.* 6*d.*
- (13) 16·875*l.* : 11·25 cwt. :: 5·25*l.* : 3·5 cwt.=3½ cwt.
- (14) 2 yds. : 2·5 yds. :: ·75 yds. : 6·66 yds.
- (15) 6·66 yds. : ·75 yds. :: 2·5 yd. : 2 yds. nearly.
- (16) (1×14×11×6=)924 : 120 lb. :: (50×20×11×5=)55000 : 7142·857 lb.



RULE OF FIVE IN DECIMALS.

Example (1) is worked.

$$(2) \quad \begin{array}{ccccc} \text{£} & & \text{£} & & \text{£} \\ *700 & : & 26.25 & : : & 100 \\ *9 \text{ m.} & \text{---} & & & 12 \text{ m.} \end{array}$$

then, $100 \times 12 \times 26.25 = 31500$ dividend,

and, $700 \times 9 = 6300$ divisor,

∴ $31500 \div 6300 = 5\%$ per cent.

SINGLE FELLOWSHIP.

$$(3) \quad \begin{array}{ccccc} & \text{days} & & \text{roods} & & \text{days} \\ *13 & : & 25\cdot5 & : : & 28 \\ *4 \text{ m.} & & \text{—} & & 36 \text{ m.} \end{array}$$

$$\text{then, } \frac{25\cdot5 \times 28 \times 36}{42 \times 4} = \frac{25704}{52} = 494\cdot3 \text{ roods.}$$

$$(4) \quad \begin{array}{ccccc} & \text{wks.} & & \text{£} & & \text{wks.} \\ *42 & : & 240 & : : & 92 \\ *12 \text{ p.} & & \text{—} & & 28 \text{ p.} \end{array}$$

$$\text{then, } \frac{240 \times 92 \times 28}{42 \times 12} = \frac{618240}{504} = 1226\cdot666 = 1226\text{l. } 13\text{s. } 4\text{d.}$$

$$(5) \quad \begin{array}{ccccc} & \text{r.} & & \text{T.} & & \text{s.} \\ *6 & : & 3 & : : & 420 \\ 1\cdot5 \text{ d.} & & \text{—} & & 9 \text{ d.*} \\ 1\cdot5 \times 3 \times 420 & : & 1890 & & \\ \text{—} & & \text{—} & & \text{—} \\ 6 \times 9 & & 54 & & \end{array}$$

$$= 35 \text{ tailors.}$$

$$(6) \quad \begin{array}{ccccc} & \text{cut.} & & \text{d.} & & \text{cut.} \\ *1 & : & 6\cdot5 & : : & 5 \\ *20 \text{ m.} & & \text{—} & & 100 \text{ m.} \\ 6\cdot5 \times 5 \times 100 & : & 3250 & & \\ \text{—} & & \text{—} & & \text{—} \\ 20 & & 20 & & \end{array}$$

SINGLE FELLOWSHIP.

Example. (1) is worked.

- (2) First, $1500 + 900 + 600 = 3000$ joint stock;
then, $600 \div 3000 = \cdot 2$ common multiplier;

$$\text{hence, } \left\{ \begin{array}{l} 1500 \\ 900 \\ 600 \end{array} \right\} \times \cdot 2 = \begin{array}{l} 300 \text{ A's gain.} \\ 180 \text{ B's gain.} \\ 120 \text{ C's gain.} \\ \hline \text{£ } 600 \text{ proof.} \end{array}$$

- (3) First, $2400 + 9600 + 4000 = 16000$ whole stock ;
then, $1600 \div 16000 = \cdot 1$ common multiplier ;

$$\text{hence, } \begin{Bmatrix} 2400 \\ 9600 \\ 4000 \end{Bmatrix} \times \cdot 1 = \begin{Bmatrix} 240 \text{ A's loss.} \\ 960 \text{ B's loss.} \\ 400 \text{ C's loss.} \end{Bmatrix}$$

£ 1600 proof.

- (4) First, $1 + 2 + 3 = 6^*$ sum of the ratios ;
then, $480 \div 6 = 80$ common multiplier ;

$$\text{and, } \begin{Bmatrix} 1 \\ 2 \\ 3 \end{Bmatrix} \times 80 = \begin{Bmatrix} 80 \text{ 1st person's share.} \\ 160 \text{ 2d person's share.} \\ 240 \text{ 3d person's share.} \end{Bmatrix}$$

£ 480 proof.

- (5) First, $520 + 680 + 800 = 2000$ amount of credit ;
then, $920 \div 2000 = \cdot 46$ common multiplier ;

$$\text{hence, } \begin{Bmatrix} 520 \\ 680 \\ 800 \end{Bmatrix} \times \cdot 46 = \begin{Bmatrix} 239 \cdot 2 = 239 \text{ } 4 \text{ } 0 \text{ A's due.} \\ 312 \cdot 8 = 312 \text{ } 16 \text{ } 0 \text{ B's due.} \\ 368 \cdot 0 = 368 \text{ } 0 \text{ } 0 \text{ C's due.} \end{Bmatrix}$$

£ 920 0 0 proof.

- (6) First, $360 + 480 + 500 + 600 = 1940$ whole adventure ;
then, $970 \div 1940 = \cdot 5$ common multiplier ;

$$\text{whence, } \begin{Bmatrix} 360 \\ 480 \\ 500 \\ 600 \end{Bmatrix} \times \cdot 5 = \begin{Bmatrix} 180 \text{ A's share.} \\ 240 \text{ B's share.} \\ 250 \text{ C's share.} \\ 300 \text{ D's share.} \end{Bmatrix}$$

£ 970 proof.

* In questions of this sort, any numbers may be taken at pleasure that have the same proportions as those proposed.

- (7) First, $180 + 240 + 250 + 300 = 970$ whole gain;
then, $970 \div 1940 = .5$ common divisor;

$$\text{when, } \left\{ \begin{array}{l} 180 \\ 240 \\ 250 \\ 300 \end{array} \right\} + .5 = \left\{ \begin{array}{l} 360 \text{ A's stock.} \\ 480 \text{ B's stock.} \\ 500 \text{ C's stock.} \\ 600 \text{ D's stock.} \end{array} \right.$$

£ 1940 proof.

- (8) First, $\frac{3}{4} + \frac{3}{8} = \frac{3}{8} + \frac{3}{8} = \frac{3}{4}$ A and B advanced;
then, $\frac{3}{8} - \frac{3}{8} = \frac{1}{8}$ C's part of the ship, worth 120%.
Now by neglecting the denominators we have,

$$11\% : 120\% :: \left\{ \begin{array}{l} 24 \\ 21 \\ 11 \end{array} \right\} : \left\{ \begin{array}{l} 261 \cdot 8181 = 261 \text{ } 16 \text{ } 4\frac{1}{4} \text{ A paid.} \\ 229 \cdot 0909 = 229 \text{ } 1 \text{ } 9\frac{1}{4} \text{ B paid.} \\ 120 \cdot 0000 = 120 \text{ } 0 \text{ } 0 \text{ C paid.} \end{array} \right.$$

£ 610 18 2 sloop
[cost.]

DOUBLE FELLOWSHIP,

Example (1) is worked.

- (2) First, $\frac{\text{£}}{\text{mo.}} 8 + 4 = 2$
 $16 \div 6 = 2 \cdot 66$

$$\text{then, } 4 \cdot 66 : 224 :: \left\{ \begin{array}{l} 2 : 96 \text{ A's stock.} \\ 2 \cdot 66 : 128 \text{ B's stock.} \end{array} \right.$$

£ 224 proof.

(3)

First, $240 \times 8 = 1920$ A's stock and time.
 $500 \times 4 = 2000$ B's stock and time.
 $200 \times 5 = 1000$ C's stock and time.

4920)369·000(.075 common multiplier;

then, $\begin{Bmatrix} 1920 \\ 2000 \\ 1000 \end{Bmatrix} \times .075 = \begin{Bmatrix} 144 \text{ A's share of the gain.} \\ 150 \text{ B's share of the gain.} \\ 75 \text{ C's share of the gain.} \end{Bmatrix}$

£ 369 proof.

(4)

$\begin{array}{r} \text{mo} \\ 11 \\ 9 \\ \hline 20 \end{array} : \begin{array}{r} \text{£} \\ 1200 \end{array} :: \begin{array}{r} \text{mo.} \\ \{ 11 \\ 9 \} \end{array} : \begin{array}{r} \text{£} \\ \{ 660 \text{ A's stock.} \\ 540 \text{ B's stock.} \end{array}$

£ 1200 proof.

(5)

First, $\begin{array}{l} 50 \times 4 = 200 \\ 130 \times 3 = 390 \\ 60 \times 6 = 360 \\ 20 \times 4 = 80 \\ 100 \times 6 = 600 \\ 50 \times 5 = 250 \end{array} \left. \vphantom{\begin{array}{l} 50 \times 4 = 200 \\ 130 \times 3 = 390 \\ 60 \times 6 = 360 \\ 20 \times 4 = 80 \\ 100 \times 6 = 600 \\ 50 \times 5 = 250 \end{array}} \right\} \begin{array}{l} 590 \text{ A's products.} \\ 440 \text{ B's products.} \\ 850 \text{ C's products.} \end{array}$

sum 1880)362·0(.1925 com. multiplier;

then, $\begin{Bmatrix} 590 \\ 440 \\ 850 \end{Bmatrix} \times .1925 = \begin{Bmatrix} 113·575 \text{ A's share.} \\ 84·700 \text{ B's share.} \\ 163·625 \text{ C's share.} \end{Bmatrix}$

proof £ 361·900 = 362l. 18s.

(6)

First, $64.5 \times 4.5 = 290.25$ A's stock and time.
 $78.75 \times 6 = 472.5$ B's stock and time.
 $112.7 \times 8.75 = 986.125$ C's stock and time.
 $125.25 \times 5.25 = 657.5625$ D's stock and time.

£ 2406.4375 sum.

2406.4375)108.91875(.045261 common multiplier;

then, $\left\{ \begin{array}{l} 290.25 \\ 472.5 \\ 986.125 \\ 657.5625 \end{array} \right\} \times .045261 = \left\{ \begin{array}{l} 13.1370 \text{ A's gain.} \\ 21.3859 \text{ B's gain.} \\ 44.633 \text{ C's gain.} \\ 29.762 \text{ D's gain.} \end{array} \right.$

proof £ 108.9179 = 108 18 4½ £ s. d.

SIMPLE INTEREST.

(1)

£
 364 principal.
 .05 ratio.
18.20 = 18*l.* 4*s.* ans.

(2)

£
 486 principal.
 .05 ratio.
24.30
 5 No. of years.
£ 121.5 = 121*l.* 10*s.* ans.

(3)

£
 884
 7
6188
 .05
309.40 = 309*l.* 8*s.*

(4)

£
 1001
 6
6006
 .045
270.270 = 270*l.* 5*s.* 4½*d.*

(5)

$$\begin{array}{r} \text{£} \\ 1205 \\ \cdot 5 \\ \hline 6025 \\ \cdot 04 \\ \hline \end{array}$$

$$24 \cdot 100 = 24\text{£. } 2\text{s.}$$

(6)

$$\begin{array}{r} \text{£} \\ 640 \cdot 4166 \\ 7 \\ \hline 4482 \cdot 9162 \\ \cdot 05 \\ \hline \end{array}$$

$$224 \cdot 145810 = 224\text{£. } 2\text{s. } 11\text{d.}$$

$$(7) \quad 9640 \cdot 833 \times 4 \cdot 75 \times \cdot 05 = 2289 \cdot 6978375 = 2289\text{£. } 13\text{s. } 11\frac{1}{2}\text{d.}$$

$$(8) \quad \cdot 0001369863 \times 641 \times 50 = 4 \cdot 390410915 = 4\text{£. } 7\text{s. } 9\frac{1}{2}\text{d.}$$

$$(9) \quad \cdot 00012528767 \times 2000 \times 63 = 15 \cdot 53424642 = 15\text{£. } 10\text{s. } 8\text{d.}$$

$$(10) \quad \cdot 00010958904 \times 5800 \cdot 83 \times 260 =$$

$$\begin{array}{r} 165 \cdot 283921634832 \text{ interest.} \\ 5800 \cdot 83 \text{ principal.} \\ \hline \end{array}$$

$$5966 \cdot 113921634832 = 5966\text{£. } 2\text{s. } 4\text{d.}$$

$$(11) \quad \cdot 0001369863 \times 563 \cdot 627 \times 265 = 20 \cdot 4604319871765 \\ = 20\text{£. } 9\text{s. } 2\frac{1}{2}\text{d.}$$

NOTE. These questions are all proved by Simple Interest in Whole Numbers; see Interest, page 79.

$$(12) \quad 5 \times \cdot 04 = \cdot 2 \text{ product of ratio and time; } \\ \text{then, } 12 \div \cdot 2 = 60\text{£.}$$

$$(13) \quad \text{First, } 4 \times \cdot 05 = \cdot 2 \text{ product of ratio and time; } \\ \text{then, } 124 \div \cdot 2 = 620\text{£.}$$

$$(14) \quad \text{First, } 3 \times \cdot 05 = \cdot 15 \text{ product of ratio and time; } \\ \text{then, } 69 \cdot 675 \div \cdot 15 = 464 \cdot 5 = 464\text{£. } 10\text{s.}$$

$$(15) \quad 4 \cdot 5 \times \cdot 04 = \cdot 18 \text{ product of ratio and time; } \\ \text{then, } 58 \cdot 725 \div \cdot 18 = 326 \cdot 25\text{£. } = 326\text{£. } 5\text{s.}$$

SIMPLE INTEREST.

- (16) $5 \times .04 = .2$ ratio and time;
 add 1.

 then, 1.2 divisor;

 hence, $72 \div 1.2 = 60$ l.
- (17) $4 \times .05 + 1 = .2 + 1 = 1.2$ divisor;
 then, $744 \div 1.2 = 620$ l.
- (18) $.05 \times 3 + 1 = .15 + 1 = 1.15$ divisor;
 then, $534.175 \div 1.15 = 464.5 = 464$ l. 10s.
- (19) $.04 \times 4.5 + 1 = 1.18$ divisor;
 then, $384.975 \div 1.18 = 326.25$ l. = 326l. 5s.
- (20) $60 \times .04 = 2.4$ product of principal and ratio;
 then, $12 \div 2.4 = 5$ years.
- (21) $620 \times .05 = 31$ divisor;
 then, $124 \div 31 = 4$ years.
- (22) $464.5 \times .05 = 23.225$ divisor;
 then, $69.675 \div 23.225 = 3$ years.
- (23) $326.25 \times .04 = 13.05$ divisor;
 then, $58.725 \div 13.05 = 4.5 = 4\frac{1}{2}$ years.
- (24) First, $72 - 60 = 12$ dividend,
 and, $60 \times .04 = 2.4$ divisor;
 hence, $12 \div 2.4 = 5$ years.
- (25) First, $620 \times .05 = 31$ divisor,
 and, $744 - 620 = 124$ dividend;
 then, $124 \div 31 = 4$ years.
- (26) First, $464.5 \times .05 = 23.225$ divisor,
 and, $534.175 - 464.5 = 69.675$ dividend;
 then, $69.675 \div 23.225 = 3$ years.
- (27) First, $326.25 \times .04 = 13.05$ divisor,
 and, $384.975 - 326.25 = 58.725$ dividend
 then, $58.725 \div 13.05 = 4.5 = 4\frac{1}{2}$ years.
- (28) $12 \div \overline{60 \times 5} = 12 \div 300 = .04 = 4$ per cent.

$$(29) \quad 124 + \frac{620 \times 4}{100} = 124 + 2480 = .05 = 5 \text{ per cent.}$$

$$(30) \quad 69.675 + \frac{464.5 \times 3}{100} = .05 = 5 \text{ per cent.}$$

$$(31) \quad 58.725 + \frac{326.25 \times 4.5}{100} = .04 = 4 \text{ per cent.}$$

$$(32) \quad \frac{72 - 60}{60 \times 5} = \frac{12}{300} = .04 = 4 \text{ per cent.}$$

$$(33) \quad \frac{744 - 620}{640 \times 4} = \frac{124}{2480} = .05 = 5 \text{ per cent.}$$

$$(34) \quad \frac{534.175 - 464.5}{464.5 \times 3} = \frac{69.675}{1393.5} = .05 = 5 \text{ per cent}$$

$$(35) \quad \frac{384.975 - 326.25}{326.25 \times 4.5} = \frac{58.725}{1468.125} = .04 = 4 \text{ per cent.}$$

DISCOUNT.

Example (1) is worked.

(2)

First, $.05 \times 1 + 1 = 1.05\%$ amount of 1*l.* for the given time,
and $50 \times .05 \times 1 = 2.5\%$ interest of the debt;
then, $1.05\% : 1\% :: 2.5\% : 2.38\% = 2\text{ } 7\text{s. } 7\frac{1}{4}\text{d. disc.}$

(3)

First, $.05 \times 1 + 1 = 1.05\%$ amount of 1*l.* for the given time,
and $200 \times .05 \times 1 = 10\%$ interest of the debt;

then, $105\% : 1\% :: 10\% : 9.5238 = \begin{array}{r} \text{£} \quad \text{s.} \quad \text{d.} \\ 9 \quad 10 \quad 5\frac{1}{2} \text{ disc.} \\ 200 \quad 0 \quad 0 \text{ principal.} \end{array}$
 $\text{diff. } \text{£ } 190 \quad 9 \quad 6\frac{1}{2} \text{ worth.}$

(4)

First, $\cdot 05 \times \cdot 25 + 1 = 1\cdot 0125$ amt. of 1*l.* for the given time,
and $36 \times 05 \times \cdot 25 = \cdot 45$ interest of the debt;

then, $1\cdot 0125*l.* : 1*l.* :: \cdot 45*l.* : \cdot 444 = \begin{array}{r} \text{£} \quad \text{s.} \quad \text{d.} \\ 0 \quad 8 \quad 10\frac{1}{2} \text{ disc.} \\ 36 \quad 0 \quad 0 \text{ prin.} \end{array}$

diff. £ 35 11 $\frac{1}{2}$ 1 $\frac{1}{2}$ worth

(5)

First, $\cdot 045 \times 3 + 1 = 1\cdot 135$ amount of 1*l.* for the given time,
and $573\cdot 8 \times \cdot 045 \times 3 = 77\cdot 463$ interest of the debt;

then, $1\cdot 135*l.* : 1*l.* :: 77\cdot 463*l.* : 68\cdot 249*l.* = \begin{array}{r} \text{£} \quad \text{s.} \quad \text{d.} \\ 68 \quad 4 \quad 11\frac{1}{4} \text{ dis.} \end{array}$

First,

(6)

$\cdot 04375 \times 1\cdot 75 + 1 = 1\cdot 0765625$ amount of 1*l.* for the time,
and $130 \times \cdot 04375 \times 1\cdot 75 = 9\cdot 953125$ interest of the debt;

then, $1\cdot 0765625*l.* : 1*l.* :: 9\cdot 953125*l.* : 9\cdot 245*l.*$

$= \begin{array}{r} \text{£} \quad \text{s.} \quad \text{d.} \\ 9 \quad 4 \quad 10\frac{1}{2} \text{ disc.} \\ 130 \quad 0 \quad 0 \text{ prin.} \end{array}$

£ 120 15 1 $\frac{1}{4}$ present money.

(7)

First, $\cdot 05 \times 2 + 1 = 1\cdot 01$ amount of 1*l.* for the given time,
and $399\cdot 666 \times \cdot 05 \times 2 = 3\cdot 99666$ interest of the debt;

then, $1\cdot 01*l.* : 1*l.* :: 3\cdot 99666*l.* : 3\cdot 975*l.*$

$= \begin{array}{r} \text{£} \quad \text{s.} \quad \text{d.} \\ 3 \quad 19 \quad 1\frac{1}{2} \text{ disc.} \\ 399 \quad 13 \quad 4 \text{ prin.} \end{array}$

£ 395 14 2 $\frac{1}{2}$ present worth of the bill.

COMPOUND INTEREST.

Example (1) is worked.

(2) $1\cdot 05 \times 1\cdot 05 \times 1\cdot 05 \times 1\cdot 05 \times 100 = 121\cdot 550625 = 121*l.*$
11*s.* 0 $\frac{1}{2}$ *d.* ans.

(3)

$$\begin{array}{r}
 \text{£} \\
 100 \text{ principal} \\
 \underline{.05} \\
 2)5.00 \\
 \underline{2.5} \\
 +100 \\
 102.5 = 1\text{st half year's amount.} \\
 \underline{.05} \\
 2)5.125 \\
 \underline{2.5625} \\
 +102.5 \\
 105.0625 = 2\text{d half year's amount.} \\
 \underline{.05} \\
 2)5.253125 \\
 \underline{2.6265625} \\
 +105.0625 \\
 107.6890625 = 3\text{d half year's amount.} \\
 \underline{.05} \\
 2)5.384453125 \\
 \underline{2.6922265625} \\
 +107.6890625 \\
 110.3812890625 = 4\text{th half year's amt.} \\
 \underline{.05} \\
 2)5.519064453125 \\
 \underline{2.7595322265625} \\
 +110.3812890625 \\
 113.1408212890625 = 5\text{th half year's amt.} \\
 \underline{.05} \\
 2)5.657041064453125 \\
 \underline{2.8285205322265625} \\
 +113.1408212890625 \\
 \text{£ } 115.9693418212890625 = 115\text{£. } 19\text{s. } 4\frac{1}{2}\text{d.}
 \end{array}$$

COMPOUND INTEREST.

$$\begin{array}{r}
 \text{(4)} \quad \begin{array}{r}
 \text{£} \\
 100 \text{ principal.} \\
 \underline{.05} \\
 4)5\text{-}00 \\
 \underline{1\text{-}25} \\
 +100 \\
 \hline
 101\text{-}25 = \text{1st quarter's amount.} \\
 \underline{.05} \\
 4)5\text{-}0625 \\
 \underline{1\text{-}2656} \\
 +101\text{-}25 \\
 \hline
 102\text{-}5156 = \text{2d quarter's amount.} \\
 \underline{.05} \\
 4)5\text{-}125780 \\
 \underline{1\text{-}281445} \\
 +102\text{-}5156 \\
 \hline
 103\text{-}797045 = \text{3d quarter's amount.} \\
 \underline{.05} \\
 4)5\text{-}18985225 \\
 \underline{1\text{-}29746306} \\
 +103\text{-}797045 \\
 \hline
 105\text{-}09450806 = \text{4th quarter's amount.} \\
 \underline{.05} \\
 4)5\text{-}2547254030 \\
 \underline{1\text{-}3136813507} \\
 +105\text{-}09450806 \\
 \hline
 106\text{-}4081894107 = \text{5th quarter's amount.} \\
 \underline{.05} \\
 4)5\text{-}320409470535 \\
 \underline{1\text{-}330102367633} \\
 +106\text{-}4081894107 \\
 \hline
 \text{£ } 107\text{-}738291778333 = 107\text{l. } 14\text{s. } 9\text{d.}
 \end{array}
 \end{array}$$

$$(5) \quad \begin{array}{r} 1.04 \times 1.04 \times 1.04 \times 1.04 \times 1.04 \times 450 = \\ 547.49380608 \text{ amount in 5 years.} \\ 450 \text{ principal.} \end{array}$$

$$\underline{\underline{97.49380608 = 97\text{ l. } 9\text{ s. } 11\frac{1}{2}\text{ d. the interest.}}}$$

ARITHMETICAL PROGRESSION.

PROBLEM I.

Example (1) is worked.

$$(2) \quad \begin{array}{r} 33 + 3 \times 11 \quad 396 \\ \hline 2 \quad 2 \end{array} = 198 \text{ ans.}$$

$$(3) \quad \begin{array}{r} 27 + 3 \times 7 \quad 210 \\ \hline 2 \quad 2 \end{array} = 105\text{ s.} = 5\text{ l. } 5\text{ s.}$$

$$(4) \quad \begin{array}{r} 60 + 1 \times 60 \quad 3660 \\ \hline 2 \quad 2 \end{array} = 1830 \text{ yds.} = 1 \text{ mile } 70 \text{ yds.}$$

PROBLEM II.

Example (1) is worked.

$$(2) \quad \begin{array}{r} 33 - 3 \quad 30 \\ \hline 11 - 1 \quad 10 \end{array} = 3 \text{ common difference.}$$

$$(3) \quad \begin{array}{r} 27 - 3 \quad 24 \\ \hline 7 - 1 \quad 6 \end{array} = 4\text{ s. difference per yard.}$$

$$(4) \quad \begin{array}{r} 60 - 1 \quad 59 \\ \hline 60 - 1 \quad 59 \end{array} = 1 \text{ common difference.}$$

PROBLEM III.

Example (1) is worked.

$$(2) \quad \frac{33-3}{3} + 1 = 10 + 1 = 11 \text{ the number of terms.}$$

$$(3) \quad \frac{27-3}{4} + 1 = 6 + 1 = 7$$

$$(4) \quad \frac{60-1}{1} + 1 = 59 + 1 = 60$$

PROBLEM IV.

Example (1) is worked.

$$(2) \quad 56 - 19 - 1 \times 3 = 56 - 54 = 2 \text{ the first term.}$$

$$(3) \quad 27 - 7 - 1 \times 4 = 27 - 24 = 3s. \text{ the first yard.}$$

GEOMETRICAL PROGRESSION.

PROBLEM I.

Example (1) is worked.

$$(2) \quad \frac{8192 \times 2 - 2}{2 - 1} = 16382 \text{ the sum of the series}$$

$$(3) \quad \frac{2048 \times 2 - 1}{2 - 1} = 4095$$

$$(4) \quad \frac{32768 \times 4 - 2}{4 - 1} = \frac{131070}{3} = 43690 \text{ sum of the series in [farthings ;}$$

then, 43690 far. = 45*l*. 10*s*. 2½*d*.

PROBLEM II.

Example (1) is worked.

- (2) First, $\begin{cases} 1. 2. 3. 4. 5. 6. 7. & \text{indices.} \\ 2. 4. 8. 16. 32. 64. 128. & \text{terms.} \end{cases}$

Then, $7+6=13$ number of terms;
and, $128 \times 64=8192$.

- (3) First, $\begin{cases} 0. 1. 2. 3. 4. 5. 6. & \text{indices.} \\ 1. 2. 4. 8. 16. 32. 64. & \text{terms.} \end{cases}$

Then, $6+5=11$ number of terms less;
and, $64 \times 32=2048s.=102l. 8s.$ the last payment;
then, $2048-1=2047+2048=4095s.=204l. 15s.$ the debt.

- (4) First, $\begin{cases} 0. 1. 2. 3. 4. & \text{indices.} \\ 2. 8. 32. 128. 512. & \text{terms.} \end{cases}$

and, $4+3=7$ number of terms less;

Then, $\frac{512 \times 128}{2}=32768$ eldest child's fortune;

and, $\frac{32768 \times 4 - 2}{4-1} = \frac{131070}{3} = 43690l.$ the whole estate.

PERMUTATION.

Example (1) is worked.

- (2) $1 \times 2 \times 3 \times 4 \times 5 \times 6 \times 7 \times 8 \times 9=362880$ days.
(3) $1 \times 2 \times 3 \times 4 \times 5 \times 6=720$ positions;
and, $720+2=360$ days.
(4) $1 \times 2 \times 3 \times 4 \times 5 \times 6=720$ changes.

SINGLE POSITION.

Example (1) is worked.

$$(2) \quad \left. \begin{array}{l} \frac{1}{2} \\ \frac{1}{3} \\ \frac{1}{5} \end{array} \right\} \text{ of 60 crowns} = \left\{ \begin{array}{l} 30 \\ 20 \\ 12 \end{array} \right.$$

sum 62 but should be 60;

$$\therefore 62 : 60 :: \left\{ \begin{array}{l} 30 \\ 20 \\ 12 \end{array} \right\} : \left\{ \begin{array}{l} 29 \frac{2}{3} \text{ A's share.} \\ 19 \frac{2}{3} \text{ B's share.} \\ 11 \frac{2}{3} \text{ C's share.} \end{array} \right.$$

crowns 60 proof.

(3) Suppose he had 120*l.* at first;

$$\text{then, } \left\{ \begin{array}{l} \frac{1}{2} \\ \frac{1}{3} \\ \frac{1}{5} \end{array} \right\} \text{ of 120} = \left\{ \begin{array}{l} 40 \\ 30 \\ 24 \end{array} \right.$$

94 sum, which
taken from 120

leaves 26 which should be 104.

$$\therefore 26*l.* \cdot 104*l.* :: 120*l.* : 480*l.* the sum he had
[at first.]$$

(4) Suppose he lent 5*l.*;then, $5 \times .05 \times 20 = 5*s.*$ interest for 1 year;

$$\text{and, } 12 \times 5*s.* = 60 = \begin{array}{r} \text{\textit{s}} \quad \text{\textit{s}} \quad \text{\textit{d.}} \\ 3 \quad 0 \quad 0 \text{ interest for 12 years.} \\ 5 \quad 0 \quad 0 \text{ principal.} \end{array}$$

£ 8 0 0 amt. but should be 500*l.*

$$\therefore 8*l.* : 5*l.* :: 500*l.* : 312*l.* 10*s.* the sum lent.$$

DOUBLE POSITION.

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(5) Suppose the work be done in 24 days ;
 then, $\left\{ \begin{matrix} 12 \\ 8 \\ 6 \end{matrix} \right\} . 1 :: 24 : \left\{ \begin{matrix} 2 \text{ days done by A.} \\ 3 \text{ days done by B.} \\ 4 \text{ days done by C.} \end{matrix} \right.$
 sum 9 by them all.

$\therefore 9 \text{ d.} : 24 \text{ d.} : 1 \text{ d.} : 2\frac{2}{3} \text{ days by A, B, and C's}$
 working together.

DOUBLE POSITION.

Example (1) is worked.

(2)

\pounds	\pounds
300	300
Suppose B's share 80	Suppose B=100
220	A=200
then A's share is	diff. 100
diff. 140	should be 72
should be 72	
68	2d error + 28
1st error +	1st sup. 80
100	
6800	2d product 2240
1st product	
2240	
68-28=40	
456 0	
114=B's share.	
300	
diff. 186=A's share.	
72 proof.	

DOUBLE POSITION.

		(3)		
			£	£
First, suppose A	240	Second, sup.	260	232
	+ 50		50	50
	<hr/>		<hr/>	<hr/>
B had left	290		310	282
	+ 50		50	50
	<hr/>		<hr/>	<hr/>
B had at first	340		360	332
	+ 44		44	44
	<hr/>		<hr/>	<hr/>
B has now	384		404	376 B's m.
A has left	196		216	188
double	392		432	376
	<hr/>		<hr/>	<hr/>
1st error +	8	2d error +	28	proof.
2d sup.	260	1st sup.	240	
	<hr/>		<hr/>	
1st pro.	2080		1120	
	<hr/>		56	
			<hr/>	
			28 6720	2d product.
			8 2080	
			<hr/>	
			20 464 0	
			<hr/>	
			£ 232	A's money.
			<hr/>	

DOUBLE POSITION.

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(4).

First, suppose A worked 10 days at 32^{d.} per day = 320
 then, B worked 20 days at 26^{d.} = 520

sum 840
 should be 3^{l.} 14^{s.} = 888

1st error - 48

Second, suppose A worked 15 days at 32^{d.} = 480
 then, B worked 15 days at 26^{d.} = 390

sum 870
 should be 888

2d error - 18

1st error - 48
 2d sup. 15

2d error - 18
 1st sup. 10

1st error 48 720 prod.
 2d error 18 180

180 prod.

diff. 3^{l.} 0^{s.} 54⁰

18 days A worked.

12 days B worked.

sum 30

Now { 18 days at 32^{d.} = 576
 12 days at 26^{d.} = 312

proof 888 = 3^{l.} 14^{s.}

DOUBLE POSITION.

(5)

First, suppose A owes $\pounds 30$
 then, B owes $\pounds 70$

100

But A's $\pounds 30$
 C's $\pounds 90$

sum $\pounds 120$
 should be $\pounds 140$

1st error—20

Then, if B owes $\pounds 70$
 C owes $\pounds 90$

160

Second, suppose A owes $\pounds 52$
 then, B owes $\pounds 48$

100

Then, if B owes $\pounds 48$
 C owes $\pounds 112$

160

But A's $\pounds 52$
 C's $\pounds 112$

2d sup. $\pounds 52$
 1st error—20

sum $\pounds 164$
 should be $\pounds 140$

errors $\left\{ \begin{array}{l} 24 \quad 1040 \\ 20 \quad 720 \end{array} \right.$

2d error + $\pounds 24$

1st sup. $\pounds 30$

prod. $\pounds 720$

44)1760(40% A's debt.

176 60 B's debt.

100 C's debt.

0

200 sum.

A's $40 + B's 60 = 100\%$. B's $60 + C's 100 = 160\%$. A's $40 + C's 100 = 140\%$. proof.

MISCELLANEOUS QUESTIONS.

155

(6)
 First, sup. 1st letter's place is 9 2d, sup. 1st let. place is 6
 then, the 2d is 3 then, the 2d is 2
 and the 3d is 46 and the 3d is 31

sum 58
 should be 20

1st error + 38
 2d sup. 6

38 228
 19 171

sum 39
 should be 20

2d error + 19
 1st sup. 9

171

19) 57(3 the first letter's place.
 57

First letter's place = 3 = C }
 the second = 1 = A } ... { C A P is the orna-
 the third = 16 = P } ment.

sum 20 proof.

MISCELLANEOUS QUESTIONS.

(1)
 80 least number.
 28 difference.
 108 greater number.
 80
 Ans. 188 sum of both.

(2)
 20 left
 21 } stolen { 3 }
 42 } the { 2 } night
 84 } { 1 }
 167 sheep at first.

(3)

From the Creation to the Flood	1656
To the building of Solomon's temple	1396
To Mahomet	1630
	<hr/>
	4622
Mahomet after Christ	— 622
	<hr/>
	A. M. 4000
	<hr/>

(4)

$$\begin{array}{rcl}
 1787 - 1765 & = 22 + 24 = 46 \text{ C's} \\
 17 & + 46 = 63 \text{ A's} \\
 13 & + 63 = 76 \text{ B's}
 \end{array}
 \left. \vphantom{\begin{array}{rcl} 1787 - 1765 \\ 17 \\ 13 \end{array}} \right\} \text{age.}$$

(5)

Distance of the sun from the earth	81000000
Distance of the earth and moon	+ 240000
	<hr/>
From each other in an eclipse of the moon	81240000
	<hr/>
	81000000
	— 240000
	<hr/>
From each other in an eclipse of the sun	80760000
	<hr/>

(6)

Temple built A. M. 3000	Christ born A. M. 4000
Troy before — 443	Rome built before — 744
	<hr/>
Troy built A. M. 2557	A. M. 3256
London after + 260	Carthage built bef. — 113
	<hr/>
London built A. M. 2817	A. M. 3143
	London built 2817
	<hr/>
London older than Carthage	326 years
	<hr/>

(7)

	£	s.	d.
From the whole debt	16	13	0
Take the difference of their payments	— 6	13	3
	<hr/>		
	2)9	19	9
	<hr/>		
The half is what A has now to pay	4	19	10½
A has paid more than B	+ 6	13	3
	<hr/>		
Sum is what B has to pay	11	13	1½
	<hr/>		

(8)

First, $81000000 - 59000000 = 22000000$ miles, the distance the earth is from Venus when in perigæo.
 And, $81000000 + 59000000 = 140000000$ miles, the distance the earth is from Venus, when in apogæo.
 $. 140000000 - 22000000 = 118000000$ miles.

(9)

First, $46 \times 46 = 2116$
 and, $32 \times 12 = 384$

1732 the no. req.

(10)

£	s.	d.
18	6	4½
		12
<hr/>		
219	16	6
<hr/>		

(11)

First, $35 \times 2 = 70$
 and, $5 \times 2 + 30 = 40$

30 diff.

(12)

First, $20 + 423 + 19 = 462$, the divisor;
 then, $423 \times 462 + 20 = 195446$, the dividend.

MISCELLANEOUS QUESTIONS.

(13)

First, $109 \times 73 = 7957$ the greater number;
and, $28 \times 17 = 476$ difference;

7481 less number.

Then, $7957 + 7481 = 15438$ their sum;
also, $7957 \times 7481 = 59526917$ their product.

(14)

	£
Merchant's whole stock	13000
Gain per annum $364 \times 4 =$	1456
Ditto $586 \times 3 =$	1758
Ditto $873 \times 3 =$	2619
	<hr/>
His whole gain	5833
	<hr/>
His original stock to begin with	7167
	<hr/>

(15)

	£
To his widow	10000
To a charity	1693
To nephews $2460 \times 3 =$	7380
To nieces $2100 \times 4 =$	8400
To 20 poor housekeepers	210
To executors	420
	<hr/>
	28103
	<hr/>

(16)

First, $4429 + 43 = 103$; then, $240 - 103 = 137$.

(17)

First, $2262 + 26 = 87$, and $2262 + 87 = 26$;
then, $87 - 26 = 61$.

(18)

$5190048 + 72084 = 72$.

(19)

$$\begin{array}{r}
 \text{£} \quad \text{s.} \quad \text{d.} \\
 8) 12 \quad 8 \text{ worth of both.} \\
 \quad 1 \quad 7 \text{ worth of the purse.} \\
 \hline
 \quad 11 \quad 1 \text{ cash in the purse.} \\
 \hline
 \end{array}$$

(20)

$$\begin{array}{r}
 \text{£} \quad \text{s.} \quad \text{d.} \\
 \text{A and B had} \quad 13 \quad 10 \quad 0 \\
 \text{B and C} \quad \quad 12 \quad 12 \quad 0 \\
 \text{A and C} \quad \quad 11 \quad 16 \quad 6 \\
 \hline
 \end{array}$$

sum 37 18 6

which being divided by the number of players at each time, will give the sum won, viz.

$$\begin{array}{r}
 \text{£} \quad \text{s.} \quad \text{d.} \quad \text{£} \quad \text{s.} \quad \text{d.} \\
 37 \quad 18 \quad 6 \div 2 = 18 \quad 19 \quad 3 \text{ what was won;}
 \end{array}$$

$$\begin{array}{l}
 \text{then, from } \begin{array}{r} \text{£} \quad \text{s.} \quad \text{d.} \\ 18 \quad 19 \quad 3 \end{array} \left. \begin{array}{l} \text{take} \\ \left\{ \begin{array}{r} \text{£} \quad \text{s.} \quad \text{d.} \\ 13 \quad 10 \quad 0 \\ 12 \quad 12 \quad 0 \\ 11 \quad 16 \quad 6 \end{array} \right\} \end{array} \right\} \begin{array}{l} \text{remain} \\ \left\{ \begin{array}{r} \text{£} \quad \text{s.} \quad \text{d.} \\ 5 \quad 9 \quad 3 \text{ C's gain} \\ 6 \quad 7 \quad 3 \text{ A's gain} \\ 7 \quad 2 \quad 9 \text{ B's gain} \end{array} \right\}
 \end{array}
 \end{array}$$

(21) First, $\frac{1}{3}$ of 6=2, and $\frac{1}{4}$ of 20=5; then, as 2 : 3
:: 5 : $7\frac{1}{2}$.

(22) First, $\frac{1}{4}$ of $\frac{1}{3} = \frac{1}{12} = \frac{2}{24}$, sold: then as $\frac{2}{24}$: 1710 ::
 $\frac{2}{24}$: 3800 = 3800.

(23) Here, A goes only $\frac{1}{2}$ of the circumference in an hour, and B goes the whole circumference in an hour; so B gains $\frac{1}{2}$ of A in that time; then,

$$\begin{array}{r}
 \text{cir.} \quad \text{h.} \quad \text{cir.} \quad \text{h.} \quad \text{h. min.} \\
 \text{as } \frac{1}{2} : 1 :: 1 : 1\frac{1}{2} = 1 \quad 5\frac{1}{2}
 \end{array}$$

(24)

First, $8-5=3$ miles, B } gains of A in one day.
 and, $10-5=5$ miles, C }

Then, $\begin{matrix} m. & d. & m. & d. \end{matrix}$ $3 : 1 :: 73 : 24\frac{1}{3}$ when A and B meet;
 also, $5 : 1 :: 73 : 14\frac{2}{3}$ when A and C meet;
 and B and C can never meet with A but at the end of these periods.

\therefore B and C can never both meet with A but when some number of B's periods is equal to some number of C's periods. Therefore, find two whole numbers which are in the same proportion as $24\frac{1}{3}$ to $14\frac{2}{3}$, which will be 365 and 219; \therefore after 365 of B's periods, or 219 of A's, all three men will meet again, and not before; \therefore the time of meeting is $219 \times 24\frac{1}{3} = 5329$ days.

(25)

$\begin{matrix} h. & cis. & h. & cis. \end{matrix}$ $8 : 1 :: 22 : 2\frac{3}{4}$; then $2\frac{3}{4} - 1 = 1\frac{3}{4}$
 \therefore as $1\frac{3}{4}$ c. : 22 h. : : 1 c. : $12\frac{1}{4}$ hours.

(26)

First, $13^\circ - 1 = 12^\circ$ moon gains of the sun per day;
 and, $30^\circ \times 3 = 90^\circ$ from 1st of Aries to 1st of Cancer;
 also, $90^\circ + 3 = 93^\circ$ sun before the moon; then,
 $\begin{matrix} deg. & day & deg. & days \end{matrix}$ as $12 : 1 :: 93 : 7\frac{3}{4}$ moon overtakes the sun.
 $\therefore 7\frac{3}{4} + 3 = 10\frac{3}{4}$ degrees of Cancer.

(27)

First, $3+5=8$, then, as $8 : 400 :: 3 : 150$ less farm.
 $8 : 400 :: 5 : 250$ greater farm.

(28)

First, $3+5+8=16$; then,

$16 : 2000 :: \begin{Bmatrix} 3 \\ 5 \\ 8 \end{Bmatrix} : \begin{Bmatrix} 375 \\ 625 \\ 1000 \end{Bmatrix}$ A's share.
 B's share.
 C's share.

£ 2000 proof.

(29)

A can do $\frac{1}{3} = \frac{4}{12}$
 B can do $\frac{2}{8} = \frac{3}{12}$
 C can do $\frac{1}{4} = \frac{3}{12}$ } their sum $\frac{10}{12} = \frac{5}{6}$ work, all working together one week.
 1 week = 6 working days, and 1 day = 12 working hours.
 $\therefore \frac{5}{6}$ work : 6 days :: 1 work : $\frac{6}{5}$ days = 5 days 4 hours.

(30)

While A works $1 = \frac{10}{10}$
 B works $\frac{1}{2} = \frac{5}{10}$
 C works $\frac{1}{3} = \frac{3\frac{1}{3}}{10}$
 D works $\frac{1}{4} = \frac{2\frac{1}{2}}{10}$ } their sum $\frac{17\frac{1}{3}}{10}$, in an hour together.

$\therefore \frac{10}{17\frac{1}{3}} : 1 :: 3 : \frac{3}{17\frac{1}{3}} = 1 \text{ } 47' \text{ } 23\frac{2}{11}''$

(31)

First, $81000000 \times 81000000 = 6561000000000000$
 then, recip. as
 $1 : 6561000000000000 :: 2 : 3280500000000000$
 $\therefore \sqrt{3280500000000000} = 57275649 \text{ miles.}$

(32)

First, $13.5 - 7.5 = 6$ inches difference;
 then, as 4 : 9 :: 6 : 13.5 lb.

(33)

First, $11 \times 11 = 121$, and the square of 1 is 1; then,
 as 1 : 16.083 :: 121 : 1946.083 feet,

$16.083 \times \left\{ \begin{array}{l} 1 = 16.083 \\ 3 = 48.25 \\ 5 = 80.416 \\ 7 = 112.583 \\ 9 = 144.75 \\ 11 = 176.916 \\ 13 = 219.083 \\ 15 = 241.25 \\ 17 = 273.416 \\ 19 = 305.583 \\ 21 = 337.75 \end{array} \right\} \text{ in the } \left\{ \begin{array}{l} 1\text{st} \\ 2\text{d} \\ 3\text{d} \\ 4\text{th} \\ 5\text{th} \\ 6\text{th} \\ 7\text{th} \\ 8\text{th} \\ 9\text{th} \\ 10\text{th} \\ 11\text{th} \end{array} \right\} \text{ sec. of time.}$

1946.083 as before

(34)

Thus, as, $16.083 : 1^2 :: 400 : 24.877$
 $\therefore \sqrt{24.877} = 4.987 +$, or 5 seconds nearly.

(35)

	<i>stud.</i>	<i>days</i>		<i>stud.</i>
Here	4	: 40	:	12
	14h.:		:	10 h.
	<hr/>			<hr/>
	56			120
	40			<hr/>
	<hr/>			

12|0)224|0

18 $\frac{2}{3}$ days.

(36)

First, as $\overset{m.}{9} : \overset{gal.}{14} :: \overset{m.}{31} : \overset{gal.}{48\frac{2}{3}}$ fills in 31 minutes;
 then, $48\frac{2}{3} - 40 = 8\frac{2}{3}$ gallons in the tub at the end of
 31 minutes, and from 2 to 5 = 3 hours, or 180 minutes.

Again, as $\overset{m.}{31} : \overset{gal.}{8\frac{2}{3}} :: \overset{m.}{180} : \overset{gal.}{47\frac{2}{3}\frac{1}{4}}$ fills in 3 hours;
 and, $147 - 47\frac{2}{3}\frac{1}{4} = 99\frac{8}{31}$ gallons, wants of being full.

Also, as $\overset{gal.}{14} : \overset{m.}{9} :: \overset{gal.}{99\frac{8}{31}} : \overset{m.}{63} \overset{sec.}{48\frac{2}{3}\frac{2}{3}}$ the tub will
 be full; which, added to 5 o'clock, will give 3 minutes
 $48\frac{2}{3}\frac{2}{3}$ seconds after 6 the tub will be full.

(37)

Discharges are here made in proportion to the square root of the height of the column of water, and the square of the diameter of the discharging pipe from that column.

Therefore, the square root of $25=5$; square root of $1=1$; square root of $16=4$; and square of $2=4$.

$$\begin{array}{ccc} f. & h. & f. \\ 5 & \text{---} 1000 & 4 \\ 1 \text{ in.} & \text{---} & 4 \text{ inches.} \\ 40 \text{ hour} & \text{---} & 24 \text{ hours.} \end{array}$$

$$\text{Then, } \frac{1000 \times 4 \times 4 \times 24}{5 \times 40} = \frac{384000}{200} = 1920 \text{ hogsheads.}$$

(38)

$$150 : 560 :: \left\{ \begin{array}{l} 40 \\ 50 \\ 60 \end{array} \right\} : \left\{ \begin{array}{l} 149\frac{1}{2} \text{ A's stock.} \\ 186\frac{3}{4} \text{ B's stock.} \\ 224 \text{ C's stock.} \end{array} \right\}$$

£ 560 proof.

(39)

$$\begin{array}{l} \text{First, A's stock } \frac{\text{£}}{\text{time}} \frac{168}{5 \text{ months.}} \end{array}$$

$$18 : \frac{840}{\text{---}} :: 12 : 70 \text{ B's stock.}$$

Secondly, as $18 : 840 :: 60 : 7 \text{ months, C's time.}$

(40)

$$\text{As } \frac{\text{£}}{100} : \frac{\text{£}}{20} :: \frac{\text{£}}{400} : \frac{\text{£}}{80} \text{ for A.}$$

$$\text{Then, as } \frac{\text{£}}{80} : \frac{\text{mo.}}{12} :: \frac{\text{£}}{50} : \frac{\text{mo.}}{7\frac{1}{2}} \text{ A's time.}$$

$$\text{And, as } \frac{\text{B's time}}{5} : \frac{\text{A's stock}}{400} :: \frac{\text{A's time}}{7\frac{1}{2}} : \frac{\text{B's stock}}{600}$$

164 MISCELLANEOUS QUESTIONS

(41)

$$\begin{aligned} 100 \div 5 &= 20 \\ 300 \div 8 &= 37.5 \\ 600 \div 12 &= 50 \\ 1000 \div 15 &= 66.666 \end{aligned}$$

$$\begin{aligned} \text{sum } 174.166) 300.000 & \text{ (1.72248 common multiplier)} \\ 1.72248 \times 20 &= 34.45 \text{ acres, A's share.} \\ 1.72248 \times 37.5 &= 64.593 \text{ acres, B's share.} \\ 1.72248 \times 50 &= 86.124 \text{ acres, C's share.} \\ 1.72248 \times 66.666 &= 114.832 \text{ acres, D's share.} \end{aligned}$$

proof 300.000 acres.

(42)

First, $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{5}$, reduced to a common denominator, will be $\frac{4}{20}$, $\frac{5}{20}$, and $\frac{4}{20}$.

and, $20 \div 4 + 20 \div 5 + 20 \div 4 = 47$ by rejecting the denominators.

$$\text{Then, as } 47 : 100000 :: \begin{cases} 20 : 42553\frac{9}{47} \text{ A's part.} \\ 15 : 31914\frac{1}{47} \text{ B's part} \\ 12 : 25531\frac{1}{47} \text{ C's part} \end{cases}$$

But $25531\frac{1}{47}$ C's part being lost by his death, it must be divided between the other two in proportion as 4 to 3;

$$\text{viz. } 4 + 3 = 7 : \begin{cases} 25531\frac{1}{47} :: 4 : 14589\frac{1}{47} \\ 25531\frac{1}{47} :: 3 : 10942\frac{1}{47} \end{cases}$$

$$\therefore 42553\frac{9}{47} + 14589\frac{1}{47} = 57142\frac{10}{47} \text{ A's part.}$$

$$\text{And, } 31914\frac{1}{47} + 10942\frac{1}{47} = 42857\frac{2}{47} \text{ B's part.}$$

£ 100000 proof.

(43)

Take a number at pleasure and divide it in proportion to their shares, then proceed by the single rule of false.

A 120

B 80

C 75

D 72

$$347 : 2000 :: \begin{cases} 120 : 691\frac{3}{4} & \text{A's share.} \\ 80 : 461\frac{3}{4} & \text{B's share.} \\ 75 : 432\frac{3}{4} & \text{C's share.} \\ 72 : 414\frac{3}{4} & \text{D's share.} \end{cases}$$

£ 2000 proof.

(44)

18 months.

5=9-4 mo.

90

10 acres.

3)900

3 $\frac{1}{3}$ acres.

2700

300

diff. 3000

21 oxen.

9 mo.

189

14=18-4 mo.

2646

24 acres.

10584

5292

3)63504

3 $\frac{1}{3}$ acres.

190512

21168

211680

-103680

3)108000

36 oxen.

12 oxen.

4 mo.

48

9 mo.

432

24 acres.

1728

864

10368

10 acres

103680

(45)

First, suppose 10 = the number of the whole company at first.

Then, $10 \times 13s. = 130s.$ the whole reckoning.

Taking 3 away, 7 remains at $19\frac{1}{2}s. = 136\frac{1}{2}s.$

Should be equal to the whole reckoning = 130

first error too much, + $6\frac{1}{2}$

Second, suppose 20 = the number at first.

Then, $20 \times 13s. = 260s.$ the whole reckoning.

Taking out 3, remains 17, at $19\frac{1}{2}s.$ a-piece = $331\frac{1}{2}s.$

Should be equal the whole reckoning = 260

second error too much, + $71\frac{1}{2}$

$6\frac{1}{2} \times 20 = 130$ take

$71\frac{1}{2} \times 10 = 715$ from

65

65)585(9 at first.

585

Hence, 9 at 13s. each = 117 the reckoning. } Proof.
 6 at $19\frac{1}{2}s.$ each = 117 the same. }

(46)

From the nature of the question, it appears that the increase in the first year will be 0, in the second year 1, in the third year 1, in the fourth year 2, in the fifth year 3, in the sixth year 5, and so on to 40 years, or terms (each term being = to the sum of the two next preceding ones); whence the two last terms are 39088169 and 63245986, and the sum of them all (or the whole series) = $2 \times 63245986 + 39088169 - 1 = 165580140$, the increase required.

(47)

By the nature of the question, it appears that the increase in the third year will be 1, in the fourth year 1, in the fifth year 1, in the sixth year 2, in the seventh year 3, and so on to 20 years, or terms (each term being = to the sum of the last term and the next but one preceding); whence the three last terms are 189, 277, and 406, and the sum of them all (or the whole series) $= 2 \times 406 + 277 + 189 = 1278$ whole stock.

THE END.

LONDON :
Printed by A. & R. Spottiswoode,
New-Street-Square.





